#385

Pioneer 10 & 11

Polarization data

72-012A-07F and 73-019A-07F

PIONEER 10

POLARIZATION DATA ON TAPE

72-012A-07F

This data set has been restored. There were originally ten 7-track, 556 BPI tapes written in BCD. There is one restored tape written in ASCII. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tapes were created on a 6400 computer. The DR and DS numbers along with the corresponding D numbers are as follows:

DR#	DS#	D#	FILES	TIME SPAN
DR003978	DS003978	D028962	1 - 200	04/26/72 - 07/20/75
		D029667	201 - 224	11/25/73 - 11/28/73
		D029668	225 - 240	11/29/73 - 11/30/73
		D029670	241 - 248	12/01/73 - 12/01/73
		D029669	249 - 260	12/02/73 - 12/02/73
		D029675	261 - 268	12/03/73 - 12/03/73
		D029674	269 - 280	12/04/73 - 12/04/73
		D029673	281 - 292	12/05/73 - 12/05/73
		D029672	293 - 328	12/06/73 - 12/09/73
		D029671	329 - 364	12/10/73 - 12/15/73

REQ. AGENT	RAND NO.	ACQ. AGENT
WKD	RC7519	WSC
CMP	RC7555	
DBN	RC7947	

PIONEER 10 & 11

POLARIZATION DATA

72-012A-07F AND 73-019A-07F

This data set consists of 22 tapes. The tapes are 556, BCD, 7 track multi-filed, created on a CDC 6400 computer. These tapes are unblocked with variable record length.

Each observing day consists of two files, the header file and the data file.

PIONEER 10

D#	C#	# FILES	TIME SPAN
D-28962	C-18777	200	4/26/72 - 7/20/75
D-29667	C-19265	24	11/25/73 - 11/28/73
D-29668	C-19266	16	11/29/73 - 11/30/73
D-29669	C-19267	12	12/02/73 - 12/02/73
D-29670	C-19268	8	12/01/73 - 12/01/73
D-29671	C-19269	36	12/10/73 - 12/15/73
D-29672	C-19270	36	12/06/73 - 12/09/73
D-29673	C-19271	12	12/05/73 - 12/05/73
D-29674	C-19272	12	12/04/73 - 12/04/73
D-29675	C-19273	8	12/03/73 - 12/03/73

PIONEER 11

D#	C#	# FILES	TIME SPAN
D-28963	C-18778	242	5/30/73 - 10/29/76
D-29198	C-18927	2	12/02/74 - 12/02/74
D-29199	C-18928	2	12/01/74 - 12/01/74
D-29200	C-18929	2	11/30/74 - 11/30/74
D-29201	C-18930	2	11/29/74 - 11/29/74
D-29202	C-18931	2	11/28/74 - 11/28/74
D-29203	C-18932	1023	11/23/74 - 11/27/74
D-29662	C-19274	12	12/08/74 - 12/09/74
D-29663	C-19275	20	12/06/74 - 12/07/74
D-29664	C-19276	12	12/05/74 - 12/05/74
D-29665	C-19277	8	12/04/74 - 12/04/74
D-29666	C-19278	20	12/03/74 - 12/03/74

THE UNIVERSITY OF ARIZONA
TUCSON, ARIZONA 85721

LUNAR AND PLANETARY LABORATORY

February 7, 1977

Mrs. Winifred Cameron
Code 601
National Space Science Data Center
Goddard Space Flight Center
Greenbelt, Maryland 20771

Dear Mrs. Cameron,

I am sending to Joseph Johns, under separate cover, two magnetic tapes (2400 ft., 7 track, 556BPI, BCD, unblocked, variable record length) labeled "Pioneer 10 Imaging Photopolarimeter (IPP) Interplanetary Polarimetry (PLUM) 1972-1975" and "Pioneer 11 Imaging Photopolarimeter (IPP) Interplanetary Polarimetry (PLUM) 1973-1976".

I'm enclosing a copy of the CDC6400 program, COPTAV, used to generate these tapes. Tables I and II provide a list of Pioneer 10 and 11 observations (DAY/YR), the number of 4-roll data sets (each set may yield a polarization solution) and the number of sectors (SECT) per roll. Each sector consists of 4 words - channels BP, BS, RP, RS. Hence, the record length varies as 4*SECT. These tables also list the tape files and object observed for each day.

Each observing day consists of two files:

1. The Header record, similar to that found on the EDR. In addition, "PLUM RUN" or "EDITED PLUM RUN" indicates whether the original EDR data has been edited, prior to being averaged by program PLUM.

2. The data file consisting of 2-record sets, the spacecraft attitude ($A-B_4$) in the first record, spacecraft (EDR) housekeeping and the data (C_1-M_{56}) in the second record. Note that the second record length varies from day to day as a function of 4*SECT (Table I). Each dual record set pertains to data averaged over a single aperture (word 81 of the housekeeping). A polarimetric solution is computed from an 8-record set with records 2, 4, 6, 8 containing data for apertures .5 mr, $\lambda/2$, DP, 8 mr (4, 5, 6, 4 respectively).

Table III equates parameters A-M found in COPTAV with the conventional names or mnemonies given in Pioneer documentation. Further description of parameters C-M is found in Attachment A, NASA/ARC Pioneer Program documents PC261.04 "Pioneer F: On-Line Ground Data System, Software Specification, Spacecraft Scientific Instrument Monitoring and Data Processing" (March 1971) and PC-262.02 "Off-Line Data Processing System, Detailed Processing Requirements" (Sept. 71). The first document also provides a brief instrument description.

It should be noted that in previous discussions we had agreed that these tapes serve only as a backup for the microfiche and that they be used only in rare cases. The tapes do not contain standard deviations for intensities; this information is found only on the PLUM fiche.

I hope that the information contained in this letter will serve as documentation for the tapes. Please contact me for further clarification, if necessary.

Please hold these data under proprietary rights.

Sincerely,

Lonny Baker

LB/sm
encl.
cc: Joseph R. Johns ✓

IMAGING PHOTOPOLARIMETER (IPP)

POLARIMETRY DATA TAPE

TABLE 1. PIONEER 10

Files	Day/Year	Sets	Sectors	Object
1/2	117/1972	7	30	Jupiter
3/4	133	4	30	Jupiter
5/6	167A	4	80	Jupiter
7/8	167B	14	80	Jupiter
9/10	168	11	80	Jupiter/Sirius
11/12	169	4	55	Sirius
13/14	185	3	30	Jupiter
15/16	186	10	30	Jupiter
17/18	187	5	30	Jupiter
19/20	230	11	30	Jupiter
21/22	231	25	30	Jupiter
23/24	305/1972	12	30	Jupiter
25/26	30/1973	17	20	Jupiter
27/28	31	9	20	Jupiter
29/30	57	19	20	Jupiter
31/32	58	25	20	Jupiter
33/34	68	25	20	Jupiter
35/36	78	4	20	Jupiter
37/38	79	29	20	Jupiter
39/40	86	3	20	Jupiter
41/42	87A	45	20	Jupiter
43/44	87B	3	20	Jupiter
45/46	99	31	20	Jupiter
47/48	106	22	20	Jupiter
49/50	115	3	20	Sirius
51/52	116	17	20	Sirius/Jupiter
53/54	128	27	20	Jupiter
55/56	137	10	20	Jupiter
57/58	158	25	20	Jupiter
59/60	169	18	20	Jupiter
61/62	178	2	20	Sirius
63/64	179	15	20	Sirius
65/66	190	15	20	Jupiter
67/68	201	13	20	Jupiter
69/70	211	9	20	Jupiter
71/72	222	18	20	Jupiter
73/74	233	14	20	Sirius
75/76	234	12	20	Sirius
77/78	255	17	20	Jupiter
79/80	255	7	20	Jupiter
81/82	256	7	20	Jupiter
83/84	276	10	20	Sirius
85/86	282	6	20	Jupiter
87/88	284	2	20	Jupiter
89/90	285	2	20	Jupiter
91/92	296	14	20	Jupiter
93/94	305	5	20	Jupiter
95/96	307	9	20	Sirius
97/98	308/1973	2	20	Jupiter
99/100	001/1974	20	20	Jupiter
101/102	004	19	20	Jupiter
103/104	008	20	20	Jupiter
105/106	010/1974	13	20	Jupiter

TABLE 1. PIONEER 10 (cont'd)

Files	Day/Year	Sets	Sectors	Object
107/108	011/1974	18	20	Jupiter
109/110	015	14	20	Jupiter
111/112	023	4	20	Jupiter
113/114	025	19	20	Sirius
115/116	026	27	20	Jupiter
117/118	030	15	20	Jupiter
119/120	064	24	20	Jupiter
121/122	080	14	20	Jupiter
123/124	081	14	20	Jupiter/Sirius
125/126	082	8	20	Sirius
127/128	102	7	20	Jupiter
129/130	107	2	20	Jupiter
131/132	108	16	20	Jupiter
133/134	113	13	20	Jupiter/Sirius
135/136	114	1	20	Sirius
137/138	128	14	20	Jupiter
139/140	135	8	20	Jupiter
141/142	136	10	20	Jupiter
143/144	141	8	20	Jupiter
145/146	142	10	20	Jupiter
147/148	144	13	20	Vega/Rigel
149/150	145	6	20	Rigel
151/152	155	9	20	Jupiter
153/154	162	6	20	Jupiter
155/156	163	12	20	Jupiter
157/158	170	21	20	Jupiter
159/160	179	20	20	Sirius
161/162	180	29	20	Sirius
163/164	184	13	20	Jupiter
165/166	191	21	20	Jupiter
167/168	198	5	20	Jupiter
169/170	207	1	20	Sirius
171/172	233	11	20	Jupiter
173/174	234	13	20	Sirius
175/176	247	4	20	Jupiter
177/178	352/1974	1	20	Jupiter
179/180	59/1974	29	20	Jupiter
181/182	254	2	20	Jupiter
183/184	345/1974	2	20	Jupiter
185/186	21/1975	6	20	Jupiter
187/188	15	4	20	Sirius
189/190	34	9	20	Jupiter
191/192	41	8	20	Jupiter
193/194	62	7	20	Jupiter
195/196	107	9	20	Sirius
197/198	133	21	20	Sirius
199/200	201/1975	22	20	Sirius

TABLE II. Pioneer 11

Files	Day/Year	Sets	Sectors	Object
1/2	150/1973	19	20	Jupiter
3/4	151	32	20	Jupiter, Vega
5/6	157	21	20	Jupiter
7/8	183	21	20	Jupiter
9/10	184	6	20	Sirius
11/12	187	19	20	Mars
13/14	188	12	80	Mars
15/16	198	20	20	Venus
17/18	199	7	20	Venus
19/20	205	13	20	Venus
21/22	206	24	20	Venus
23/24	213	28	20	Jupiter
25/26	214	5	20	Jupiter
27/28	237	19	20	Jupiter
29/30	238	9	20	Jupiter
31/32	240	12	20	Vega
33/34	241	11	20	Vega
35/36	283	27	20	Jupiter
37/38	284	28	20	Vega
39/40	285	5	20	Vega
41/42	312	26	20	Jupiter
43/44	320/1973	28	20	Jupiter
45/46	35/1974	8	20	Sirius
47/48	36	1	20	Sirius
49/50	37	11	20	Jupiter
51/52	65	10	20	Sirius
53/54	66	1	20	Sirius
55/56	67	19	20	Jupiter
57/58	75	18	20	Jupiter
59/60	87	18	20	Jupiter
61/62	105	30	20	Jupiter
63/64	115	19	20	Jupiter
65/66	123	19	20	Jupiter
67/68	133	23	20	Jupiter
69/70	151	17	20	Jupiter
71/72	134	34	20	Sirius
73/74	161	37	20	Sirius
75/76	172	19	20	Jupiter
77/78	182	12	20	Jupiter
79/80	183	8	20	Sirius
81/82	192	17	20	Jupiter
83/84	204	15	20	Jupiter
85/86	212	16	20	Jupiter
87/88	232	24	20	Jupiter
89/90	238	1	20	Sirius
91/92	239	31	20	Sirius
93/94	242	11	20	Jupiter
95/96	253	10	20	Jupiter
97/98	261	8	20	Jupiter
99/100	270	21	20	Jupiter
101/102	283	32	20	Jupiter
103/104	288	15	20	Jupiter
105/106	300	11	20	Jupiter
107/108	303	10	20	Jupiter
109/110	304	8	20	Jupiter
111/112	307/1974	20	20	Jupiter

TABLE II. (cont'd)

Files	Day/Year	Sets	Sectors	Object
113/114	311/1974	17	20	Jupiter
115/116	315	16	20	Jupiter
117/118	318	17	20	Jupiter
119/120	319	16	20	Jupiter
121/122	346	10	20	Jupiter
123/124	347A	11	20	Sirius
125/126	347B	20	20	Sirius
127/128	358A	2	20	Sirius
129/130	358B	30	20	Sirius
131/132	365	15	20	Jupiter
133/134	95	18	20	Jupiter
135/136	311	17	20	Jupiter
137/138	313	17	20	Jupiter
139/140	316	7	20	Jupiter
141/142	321	17	20	Jupiter
143/144	349	17	20	Jupiter
145/146	359/1974	16	20	Jupiter
147/148	21/1975	31	20	Sirius
149/150	51	17	20	Jupiter
151/152	115	8	20	Sirius
153/154	126	18	20	Jupiter
155/156	157	22	20	Jupiter
157/158	158	6	20	Jupiter
159/160	172	19	20	Jupiter
161/162	177	31	20	Jupiter
163/164	191	29	20	Jupiter
165/166	198	20	20	Jupiter
167/168	204	16	20	Sirius
169/170	205	19	20	Jupiter
171/172	211	26	20	Jupiter
173/174	222	22	20	Jupiter
175/176	260	15	20	Jupiter
177/178	97	9	20	Jupiter
179/180	108	17	20	Jupiter
181/182	114	11	20	Sirius
183/184	141A	39	20	Sirius
185/186	141B	2	20	Sirius
187/188	239	27	20	Jupiter
189/190	276	10	20	Sirius
191/192	277	30	20	Sirius
193/194	280	18	20	Jupiter
195/196	303	10	20	Jupiter
197/198	304	7	20	Jupiter
199/200	321	18	20	Jupiter
201/202	324	9	30	Saturn
203/204	345/1975	14	20	Jupiter
205/206	29/1976	10	20	Jupiter
207/208	40	1	20	Jupiter
209/210	41	22	20	Jupiter
211/212	48	2	20	Jupiter
213/214	55	14	20	Jupiter
215/216	63	3	20	Sirius
217/218	64	24	20	Sirius
219/220	85	21	20	Jupiter
221/222	104/1976	16	20	Jupiter

TABLE II. (cont'd)

Files	Day/Year	Sets	Sectors	Object
223/224	144/1976	6	20	Jupiter
225/226	162	29	20	Jupiter
227/228	184	13	20	Jupiter
229/230	196	15	20	Sirius
231/232	210	12	20	Jupiter
233/234	222	10	20	Jupiter
235/236	240	14	20	Jupiter
237/238	253	20	20	Jupiter
239/240	264	2	20	Jupiter
241/242	303	6	20	Jupiter

TABLE III

WORD	COPTAV CODE	MNEMONIC EDR DESCRIPTION
1	A	CORRECTED MODE ID (INTEGER) EITHER MODE 3 OR MODE 4.
2	B(1)	CLAT (REAL) CELESTIAL LATITUDE OF THE + ZAXIS OF THE S/C.
3	B(2)	CLONG (REAL) CELESTIAL LONGITUDE OF THE + ZAXIS OF THE S/C.
4	B(3)	CLASUN (REAL) CLOCK ANGLE OF THE SUN.
5	B(4)	CLASTAR (REAL) CLOCK ANGLE OF THE REFERENCE STAR.
6	C(1)	GMT (INTEGER) TIME IN MILLISECONDS OF THE START OF THE DATA CYCLE.
7	C(2)	DAY (INTEGER) DAY THE DATA WAS RECEIVED.
8	C(3)	TCF (INTEGER) TIME CORRECTION FLAG. 0 = NO CORRECTION, 7 = SUSPECT TIME OR CORRECTED TIME.
9	C(4)	AREFSELS (INTEGER) REFERENCE SELECT STATUS. 0 = ERROR, 1 = STAR, 2 = SUNB, 3 = SUNA.
10	D	SNR (REAL) SIGNAL-TO-NOISE RATIO (SIGNAL + NOISE/NOISE).
11	E(1)	DSS (INTEGER) DEEP SPACE STATION WHICH WAS TRACKING.
12	E(2)	BIT RATE (INTEGER) BIT RATE AT WHICH DATA RECORD WAS TAKEN.

BCD	RATE IN BITS PER SECOND
0	16
1	32
2	64
3	128
4	256
5	512
6	1024
7	2048

13	E(3)	MODE (INTEGER) THE DATA TAKING MODE OF THE S/C.
14	E(4)	FORMAT (INTEGER) THE DATA TRANSMISSION FORMAT CODE.
15	E(5)	RTLT (INTEGER) THE ROUND TRIP LIGHT TIME IN MILLISECONDS.
16	E(6)	ESC (INTEGER) THE EXTENDED FRAME COUNT OF THE SUBCOM CYCLE.

TABLE III (Con't)

WORD	COPTAV CODE	MNEMONIC EDR DESCRIPTION
17	E(7)	ASTDLYC (INTEGER) STAR DELAY TIME.
18-21	E(8)-E(11)	FLAG 1, FLAG 2, FLAG 3, FLAG 4 (INTEGER) THESE ARE FLAGS SPF, RAT, ASPNPDC, ARIPPHEC, RESPECTIVELY.
22	F(1)	RAT (REAL) ROLL ATTITUDE TIMER.
23	F(2)	ASPNPDC (REAL) SPIN PERIOD.
24	G	SPF (INTEGER) SPIN PERIOD QUALIFIER.
25	H	ARIPPHEC (REAL) ROLL PULSE/ROLL-INDEX PULSE PHASE ERROR.
26	I	GMT OF C-112 (INTEGER) MILLISECOND RECEIVE TIME OF WORD C-112 (RAT).
27	J(1)	DC VOLT (REAL) DC BUS VOLTAGE OF S/C (C-107)
28	J(2)	DC CURR (REAL) DC BUS CURRENT OF S/C (C-129).
29	K(1)	C-124 (INTEGER) WORD C-124 INDICATES THE POWER STATUS OF IPP, 1 = ON, 0 = OFF.
30	K(2)	GMT OF C-124 (INTEGER) MILLISECOND RECEIVE TIME OF C-124.
31	L	P. TEMP (REAL) PLATFORM TEMPERATURE FROM SENSOR NEAREST IPP.
32-67	M(1)-M(36)	DQ1-36 (36 INTEGERS) 36 DATA QUALITY INDICATORS, 1 FOR EACH D FRAME OF IPP DATA.
68	M(37)	GMT OF E-217 (INTEGER) MILLISECOND RECEIVE TIME OF E-217.
69	M(38)	E-217 (INTEGER) HIGH VOLTAGE INDICATOR WORD FOR IPP.
70	M(39)	DATA CYC. GMT (INTEGER) MILLISECOND RECEIVE TIME OF FIRST BIT OF THE DATA CYCLE.
71	M(40)	SYNC (INTEGER) IPP BARKER CODE.
72	M(41)	MODE ID (INTEGER) UNCORRECTED MODE ID.
73	M(42)	ROLL (INTEGER) STARTING ROLL SPOKE.
74	M(43)	BS (INTEGER) BACK STEP.
75	M(44)	TO (INTEGER) THRESHOLD ON.
76	M(45)	LS (INTEGER) LOW SAMPLE RATE.

TABLE III (Con't)

WORD	COPTAV CODE	MNEMONIC EDR DESCRIPTION
77	M(46)	GAIN (INTEGER) GAIN STEP NUMBER.
78	M(47)	SLA (INTEGER) STARTING LOOK ANGLE IN IPP SLA REGISTER.
79	M(48)	LK. ANGLE COARSE (INTEGER) COARSE ENCODER READING.
80	M(49)	LK. ANGLE FINE (INTEGER) FINE ENCODER READING.
81	M(50)	AP (INTEGER) APERTURE CODE (4, 5, 6, 4 = 8mr, $\lambda/2$, DP, .5 mr).
82	M(51)	SI (INTEGER) STEP INHIBIT.
83-87	M(52)-M(56)	TEMP1-TEMP5 (5 INTEGERS) READINGS FROM THE 5 IPP TEMPERATURE SENSORS.
88-(88+N)	INTEN(P), P = 1, N	MODE 3 INTENSITIES (N REALS) THE IPP MODE 3 INTENSITIES ARE STORED WITH 4 CHANNELS (BP, BS, RP, RS) PER SECTOR. THE OBJECT GENERALLY APPEARS IN 1-2 SECTORS

	WORD #			
SECTOR	BP	BS	RP	RS
1	88	89	90	91
2	92	93	94	95
3	96	97	98	99
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.

3.3 DOCUMENT CONTROL

This specification shall be subject to rigid document control by NASA/ARC. In the event changes are required to this specification, replacement, or additional pages will be furnished by NASA/ARC. Replacement or additional pages will be appropriately labeled to indicate change and dates of changes.

4. PRODUCT ASSURANCE PROVISIONS

Not applicable

5. HANDLING, SHIPPING, AND STORAGE

Not applicable.

6. NOTES

6.1 ABBREVIATIONS

See section 6.1 of Specification PC-262.00 entitled Pioneer Off-Line Data Processing System at ARC.

6.2 GLOSSARY OF TERMS

See section 6.2 of Specification PC-262.00 entitled Pioneer Off-Line Data Processing System at ARC.

6.3 CLARIFICATION OF EXPERIMENTER DATA RECORD ACS PARAMETERS (Figure 6.3)

This note clarifies the inter-relationship of the Attitude Control System (ACS) parameters in the fixed header of each physical record of File 4 on the Experimenter Data Record (EDR), output by the Pioneer Off-Line Data Processing System (POLDPS) at ARC. The ACS parameters in the fixed header of the EDR are the spin period and flag, Roll Attitude Timer, Roll Pulse/Roll-Index Pulse phase error, and the GMT time of the frame in which the six most significant bits of the Roll Attitude Timer (C-112) occur. Also included will be the Roll Pulse and Roll-Index Pulse definitions which are related to the ACS parameters found on the EDR.

(a) Roll Pulse (P_R) - A pulse generated by the Attitude Control Subsystem each time the spacecraft +Y axisascends through a plane it establishes as a reference plane for the spacecraft attitude control system. Measurement Jitter and the spacecraft position relative to the sun and earth line may establish inaccuracies between this reference plane and a plane parallel to the ecliptic,Figure 6.3 shows this measurement as a possible band about the reference plane.

(b) Roll Index Pulse (P_F) - A filtered roll pulse generated by the Spin Period Sector Generator (SPSG) which occurs once per spacecraft revolution.

(c) P_8 Pulse - A square wave generated by the SPSG, which occurs with a frequency 8 times that of and in phase with the P_F pulse.

(d) P_{64} Pulse - A square wave generated by the SPSG, which occurs with a frequency 64 times that of and in phase with the P_F pulse.

(e) P_{512} Pulse - A pulse generated by the SPSG, which occurs with a frequency 64 times that of and in phase with the P_F PULSE.

(f) Roll Attitude Timing - The DTU contains a redundant 12-bit counter which is driven by a 128 bps clock and controlled by the Roll Index Pulse (P_F). The 12 bits of the counter are read out with the most significant bit first during Engineering Subcom Word C-112 and C-116 (DRATC). The counter is reset with each occurrence of the Roll-Index Pulse after the [illegible] of word gate C-125, at which time counting is resumed. The 12-bit count represents the time between the occurrence of the Roll-Index Pulse and the start of word C-112 of the Engineering Subcom. This telemetered time will permit correlating the attitude of the roll and the roll-index reference lines with given telemetered science and engineering data. Each count within the register represents 0.0078125 seconds.

(g) Roll Pulse/Roll-Index Pulse phase error (ARIPPHEC) - The phase error measurement between the Roll Pulse and Roll-Index Pulse with up to a mixiumum of x62.5 msec of phase error, generated by the SPSG.

(h) Spin Period Flag - A three bit flag extracted from Engineering Subcom Word C-417, which indicates the SPSG modes and the SPSG roll reference.

Bit 1 (ASPSGRRS):

(1) 0 indicates that the roll index pulse is in phase with the roll pulse.

(2) 1 indicates that the roll index pulse is 180 degrees out of phase with the roll pulse.

Note: The relationship between the phase of the Roll Pulse and the Roll-Index Pulse is corrected on the spacecraft by Ground Command. However, by using the spacecraft attitude information and the status of Bit 1 and ARIPPHEC, it can be verified that the correction was actually made. In general it shall never be permitted to exceed the dynamic range of ARIPPHEC.

Bits 2 and 3 (ASPSGMS):

(1) 00 - Non-averaging
(2) 01 - ACS Mode
(3) 10 - Averaging
(4) 11 - Not used

(i) GMT of the RAT - This time represents the GMT time of the first bit of the main frame in which C-112 occurs.
(j) Spin Period (ASPNPDC) - The time between two successive roll pulses.

The time of the main frame containing Engineering Subcom Word C-112 of the Roll Attitude Timer, the Spin Period and Flag, and the Roll Pulse/Roll-Index Pulse phase error is provided so that the experimenter can relate his data to the roll reference line of the spacecraft. The following will be a typical example of how these data may be used to find the time difference between the occurrence of Engineering Subcom Word C-112 and the occurrence of the Roll Reference Pulse. Also, it will show how the angle subtended between the roll reference line and any given scientific data bit can be obtained. (Reference Figure 6.3)

New RAT Determination. Data word C-112 contains the MS Bits and C-116 and LS Bits of the Roll Attitude Timer (RAT). These 12 bits shall be monitored until a change occurs between successive readings. This represents a New RAT (NEWRAT) and shall be used for processing.

Given the time of the first bit of the science main frame in which a change of Engineering Subcom Word C-112 occurs, and utilizing bit rate, the time of the first bit of Engineering Subcom Word C-112 can be extrapolated as follows:

$$GMT_{C\text{-}112_{Bit\ 1}} = T_{MF_{C\text{-}112}} + \frac{N_{Bits}}{BR\ (Bits/Sec)}$$

where: $T_{MF_{C\text{-}112}}$ - Time of the first bit of the main frame in which Engineering Subcom Word C-112 occurs.

N_{Bits} - The number of bits between the first bit of the main frame and the first bit of Engineering Subcom Word C-112. This value is equal to 108.

BR - The bit rate in which the data were transmitted.

$GMT_{C\text{-}112_{Bit\ 1}}$ - Time of the first bit of Engineering Subcom Word C-112.

At this time, the time occurrence of the Roll-Index Pulse can easily be obtained by the following relationship:

$$T_{RIP} = GMT_{C\text{-}112_{Bit\ 1}} - DRATC$$

where: T_{RIP} will be the time of the Roll-Index Pulse, which triggers the count of the Roll Attitude Timer.

(T_{PR}) is obtained by the addition or subtraction of the Roll Pulse/Roll-Index Pulse phase error. Bit 6 of Engineering Subcom Word C-408 determines whether C-408 is added or subtracted. If Bit 6 is one, the Roll Pulse occurred before the Roll-Index Pulse and the Roll Pulse/Roll-Index Pulse phase error must be subtracted from T_{RIP} as follows:

$$GMT_{PR} = T_{RIP} - ARIPPHEC$$

Otherwise, the Roll Pulse/Roll-Index Pulse phase error must be added to T_{RIP} (Bit 6 of C-408 equal to zero) as follows:

$$GMT_{PR} = T_{RIP} + ARIPPHEC$$

This indicates that the Roll-Index Pulse occurred before the Roll Pulse. However, this value on the EDR will be converted to engineering units and the proper sign is already assigned to the value of ARIPPHEC.*

After obtaining the time (GMT) of the occurrence of the Roll Pulse, the angle relationship between any bit of data and the roll reference line, of which bit rate and format must be taken into consideration, can be obtained. The following relationship is an example of how this angle is acquired:

$$\angle \text{Data Bit} = \frac{\left[\left(GMT_F\ (\text{Sec}) + \frac{M_{Bits}}{BR_{(Bits/Sec)}}\right) - GMT_{PR}\ (\text{Sec})\right] \times 360\ \text{deg/rev.}}{ASPNPDC\ (\text{Sec/Rev})}$$

where: $\angle$Data Bit - Angle subtended between a specific data bit reference line and the spacecraft roll reference line.

GMT_F - Time of the first bit of the main frame in which the particular data bit occurs.

M_{Bits} - The number of bits between the data bit being examined and the first data bit of the main frame in which it occurs.

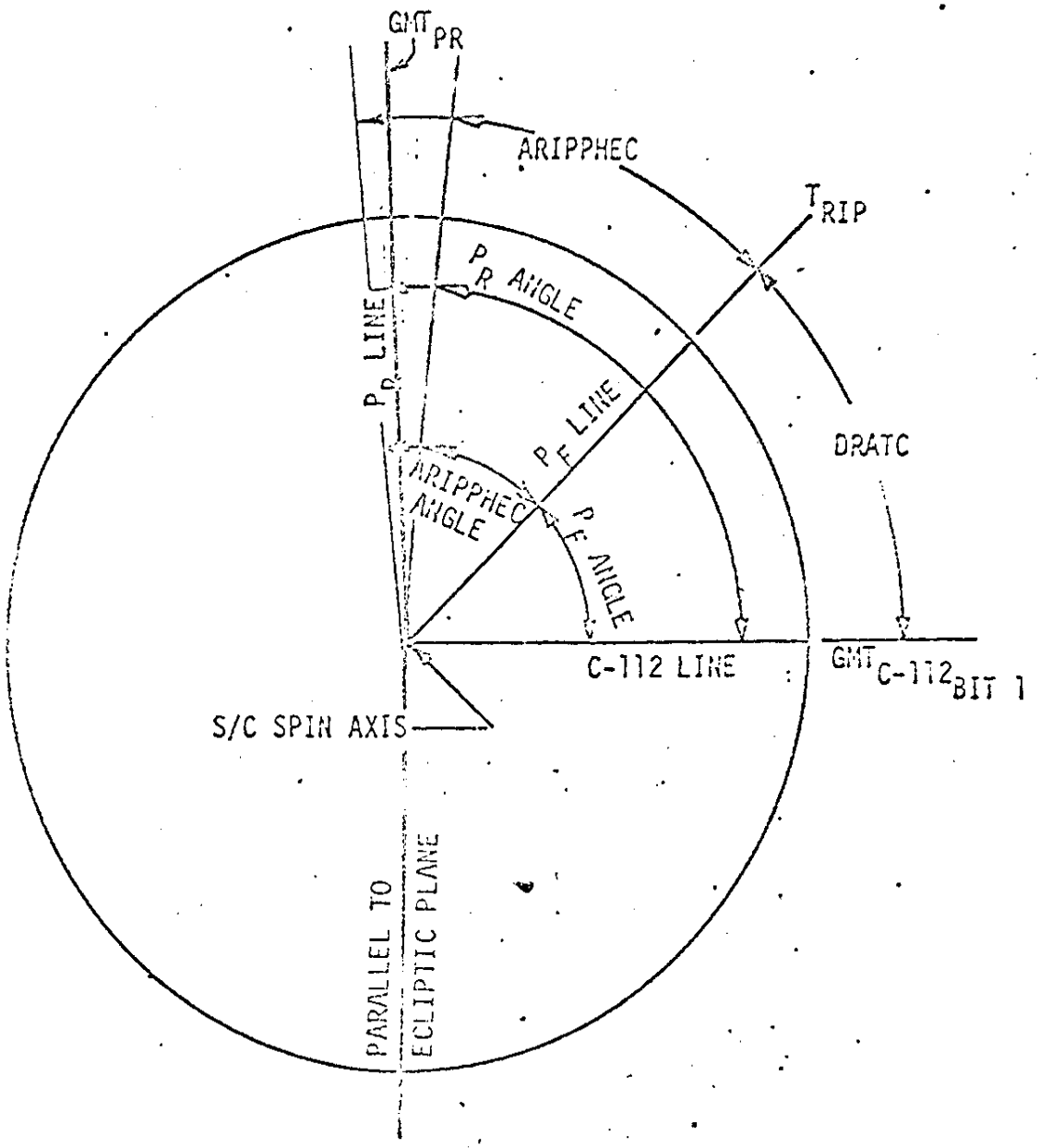
ASPNPDC - Spacecraft spin period (see definition #10).

BR - Telemetry bit rate in which the data was received.

GMT_{PR} - The time (GMT) that the spacecraft +Y axis passed, ascending, through the plane parallel to the ecliptic.

Using the instrument's look reference line, the relationship of any bit of data from the instrument to the spacecraft roll reference line can be determined.

*It should be noted that ARIPPHEC has jitter (sensor and electronic trigger errors) contained within its steady state values. To avoid the addition of this jitter into "$\angle$ Data Bit" or GMT T_{RR}", the least square Estimate (linear) Phase Error should be used in lieu of each ARIPPHEC at the time of occurrence of T_{RIP}. The technique for this utilization is a requirement in the Real-Time Data Processing System and is covered in detail in PC-261.01, Pioneer F/G: On-Line Ground Data System Software Specification for Mission Control at Space Flight Operations Facility in Section 3.5.1.1.4.



REPRODUCED FROM

TITLE

S/C ROLL REFERENCE RELATIONSHIP

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC NO [illegible]

FIG 6.3

REV NO

DATE 9/1/71

SHEET 1 OF 1

B29344-000A

DCU = C, D
DOCTYPE = 14
HCK-P

TITLE . IMAGING PHOTOPOLARIMETER TAPE USER'S GUIDE

This document describes the contents of tapes containing data from the Pioneer 10 and 11 Imaging Photopolarimeters experiment in imaging mode. These tapes have been furnished to the National Space Science Data Center by the University of Arizona.

Tape Structure

The tapes are 7-track, 2400 ft., 556 bpi, BCD, unblocked (one logical record = one physical record).

Each tape contains sets of four files. Each set contains all relevant data within a given block of time. Table 1 lists the number of records per file and the number of characters per record in a four-file set.

Tape Format and Contents

The format is identical to that of an Experimenter Data Record (EDR). The EDR is divided into groups of four files:

File 1 - contains logistics information

File 2 - contains command data

File 3 - contains attitude data of the spacecraft

File 4 - contains housekeeping data plus all intensities telemetered during a data cycle.

A data cycle is defined as one rotation of the spacecraft. The detailed contents of each file are listed in Table 2. Each record in File 4 begins with 77 "housekeeping" parameters describing the status of the instrument, time of data receipt, data quality, etc. These parameters are described in Appendices A and B, which are taken from NASA/Ames Research Center Pioneer Program Documents PC-261.04, "Pioneer F: On-Line Ground Data System, Software Specifications, Instrument Monitoring and Data Processing"

and PC-262.02, "Off-Line Data Processing System Detailed Processing Requirements," respectively. Appendix A begins with a brief description of how the imaging photopolarimeter operates.

Tape Usage

Efficient use of the tapes can be made in conjunction with the use of the Pioneer Image Log and the Pioneer Encounter Pre-Exams on microfiche. The image log gives the midtime of each image and useful geometrical data on the image, including the phase angle, longitude of the central meridian, latitude of the sub-spacecraft point, and resolution of the image. The microfiche lists the time and certain useful housekeeping parameters for each data cycle. To access the data for a certain image, one can use the following steps:

1. Consult the Pioneer Image Log to determine the midtime of the image to be studied.
2. Locate the midtime on the Pioneer Encounter Pre-Exams and determine the starting and ending day and times of the image.
3. Examine the Tape Table of Contents or the tape labels to determine which tape contains the image in question.

An example showing the steps necessary to access image C165 is given in Figure 1.

TAPE TABLE OF CONTENTS

Pioneer 10

TAPE NO.	NO. OF FILES	GREGORIAN DATE	DAY OF YEAR	JUPITER IMAGES
10-1	24	Nov. 25-Nov. 28	329-332	A191-A123
10-2	16	Nov. 29-Nov. 30	333-334	A122-A84
10-3	8	Dec. 1	335	A83-A56
10-4	12	Dec. 2	336	A55-A28
10-5	8	Dec. 3	337	A27-A4
10-6	12	Dec. 4	338	A2-B10
10-7	12	Dec. 5	339	B11-B42
10-8	36	Dec. 6-Dec. 9	340-343	B43-B139
10-9	36	Dec. 10-Dec. 15	344-349	B140-B195

TAPE TABLE OF CONTENTS

TAPE NO.	NO. OF FILES	GREGORIAN DATE	DAY OF YEAR	JUPITER IMAGES
11-1	28	Nov. 23-Nov. 27	327-331	C202-C141
11-2	8	Nov. 28	332	C140-C106
11-3	8	Nov. 29	333	C105-C82
11-4	12	Nov. 30	334	C77-C46
11-5	8	Dec. 1	335	C41-C20
11-6	12	Dec. 2	336	C18-C4
11-7	20	Dec. 3	337	C3-D10
11-8	8	Dec. 4	338	D11-D24
11-9	12	Dec. 5	339	D25-D45
11-10	20	Dec. 6-Dec. 7	340-341	D49-D82
11-11	12	Dec. 8-Dec. 9	342-343	D82-D107

TABLE 1

File Structure

FILE	RECORDS PER FILE	CHARACTERS PER RECORD
1	1	480
2	Variable	1200
3	1	Variable (<5120)
4	Variable	4080

TABLE 2

Detailed Contents of Files

File 1 (Logistics)

Physical Record 1

CHARACTER(S)	CONTENTS
1-7	"PIONEER"
9	"F" (for Pioneer 10) or "G" (for Pioneer 11).
11-13	"EDR"
15-29	NN "ACQUISITIONS" where NN is the number of acquisitions.
33-38	"UA/IPP"
40-48	"S/C ID" NN where NN is the spacecraft identification number (23 for Pioneer 10 or 24 for Pioneer 11).
50-67	"GENERATED" mm/dd/yy where the date indicates when the tape was generated.
69-88	"REGENERATED" mm/dd/yy where the date indicates when the tape was regenerated.
90-95	Day of year and year covered by this four-file group.
97-120	List of Deep Space Station that tracked during the file time period. This list will be BCD conversion of the station codes (see PC-262.04, Fig. 5-50). The entries will be two characters and will be separated by commas.
121-133	"TLM BIT RATES"
135-240	List of all the bit rates encountered on this EDR tape. The entries consist of four characters and will be separated by commas.
241-251	"TLM FORMATS"
253-360	List of all formats contained on this EDR tape. The entries consist of five alpha characters and will be separated by commas.
361-369	"MODES RT"
380-412	"START TIME" hh/mm "STOP TIME" hh/mm where the times indicate the Earth receipt start and stop times of data on this EDR.
414-480	"TAPE SEQUENCE NO." n where n is the sequence number of the tape within the listed time period.

TABLE 2 (Con't.)

Detailed Contents of Files

File 2 (Commands)

Arbitrary Physical Record

CHARACTER(S)	CONTENTS
9-25	ddd hh mm ss where the day and time indicates the Earth receipt time of the command.
28	Verification code (V indicates command was verified; N indicates command was not verified).

Each physical record contains 50 commands. The above pattern is repeated in the following characters:

31-50	271-290	511-530	751-770	991-1010
53-72	293-312	533-552	773-792	1013-1032
75-94	315-334	555-574	795-814	1035-1054
97-116	337-356	577-596	817-836	1057-1076
129-148	369-388	609-628	849-868	1089-1108
151-170	391-410	631-650	871-890	1111-1130
173-192	413-432	653-672	893-912	1133-1152
195-214	435-454	675-694	915-934	1155-1174
217-236	457-476	697-716	937-956	1177-1196
249-268	489-508	729-748	969-988	

File 3 (Attitude)

Physical Record 1

CHARACTER(S)	CONTENTS
1-9	ddd hh mmss, the day and time of the attitude measurement (UT).
10-15	Zero fill
16	FLAG: 0 = Special Refinement (±0.1 degree). 1 = High-Gain Antenna (±0.3 degree). 2 = Medium-Gain Antenna (±1.3 degree). 3 = Dynamic Position for Delta V (±3.0 degree).
17-18	Zero fill
19-24	C. LONG Celestial Longitude of the spin axis in degrees: includes decimal point and sign.
25-31	C. LAT Celestial Latitude of the spin axis in degrees: includes decimal point and sign.

TABLE 2 (Con't.)

Detailed Contents of Files

File 3 (Attitude) (Con't)

CHARACTER(S)	CONTENTS
32-37	CASUN clock angle of sun in degrees: includes decimal point and sign.
38-43	CASTAR clock angle of star in degrees: includes decimal point and sign.
44-60	Zero fill

The above sequence is repeated every 60 characters for different dates and times. A history of spacecraft attitude data is thereby available. The most recent determination is the last one.

File 4 (Experiment Data)

Arbitrary Physical Record

CHARACTER(S)	CONTENTS
5-12	GMT (INTEGER) time in milliseconds of the start of the data cycle.
16-18	DAY (INTEGER) day the data was received.
24	TCF (INTEGER) time correction flag. 0 = no correction, 7 = suspect time or corrected time.
30	AREFSELS (INTEGER) reference select status. 0 = error, 1 = star, 2 = SUNB, 3 = SUNA.
33-36	SNR (REAL) signal-to-noise ratio (signal + noise/noise).
41-42	DSS(INTEGER) deep space station which was tracking.
48	BIT RATE (INTEGER) bit rate at which data record was taken.

BCD	RATE IN BITS PER SECOND
0	16
1	32
2	64
3	128
4	256
5	512
6	1024
7	2048

TABLE 2 (Con't.)

Detailed Contents of Files

File 4 (Experiment Data) (Con't.)

CHARACTERS(S)	CONTENTS
52-54	MODE-FORMAT mode and format are two data values, one byte and two bytes respectively. MODE: the following codes are in BCD: 0 or 1 = real time 4 or 5 = telemetry store 2 or 3 = memory readout
58-66	RTLT the round trip light time will be given in total milliseconds.
69-72	ECS the extended frame counter will be a combined word from the S/C telemetry of both the subcommutator identification word and the extended frame counter word. Together they comprise a counter from 0 to 8191.
74-78	ASTDLYC star delay time.
81-84	FLAG 1, FLAG 2, FLAG 3, FLAG 4 these are flags SPF, RAT, ASPNPDC, ARIPPHEC, respectively.
88-96	RAT (roll attitude timer).
102-108	ASPNPDC (spin period).
114	SPR engineering word C-417.
126-132	ARIPPHEC roll pulse/roll-index pulse phase error.
137-144	TIME OF C-112 GMT time that C-112 the roll attitude timer was received.
146-150	DC BUS VOLTAGE (C-107)
152-156	DC BUS CURRENT (C-129)
162-174	C-124/GMT OF C-124 IPP power off/on indicator.
176-180	S/C PLATFORM TEMPERATURE temperature nearest the IPP.
181-216	DQI 36 data quality indicators, 1 for each D frame of IPP data.
221-228	GMT OF E-217 the millisecond received time of E-127.
233-234	E-217 the IPP high voltage indicator.
245-252	GMT time in milliseconds of the start of the data cycle.
256-258	SYNC CODE IPP Barker code.
264	MODE ID uncorrected.

TABLE 2 (Con't.)

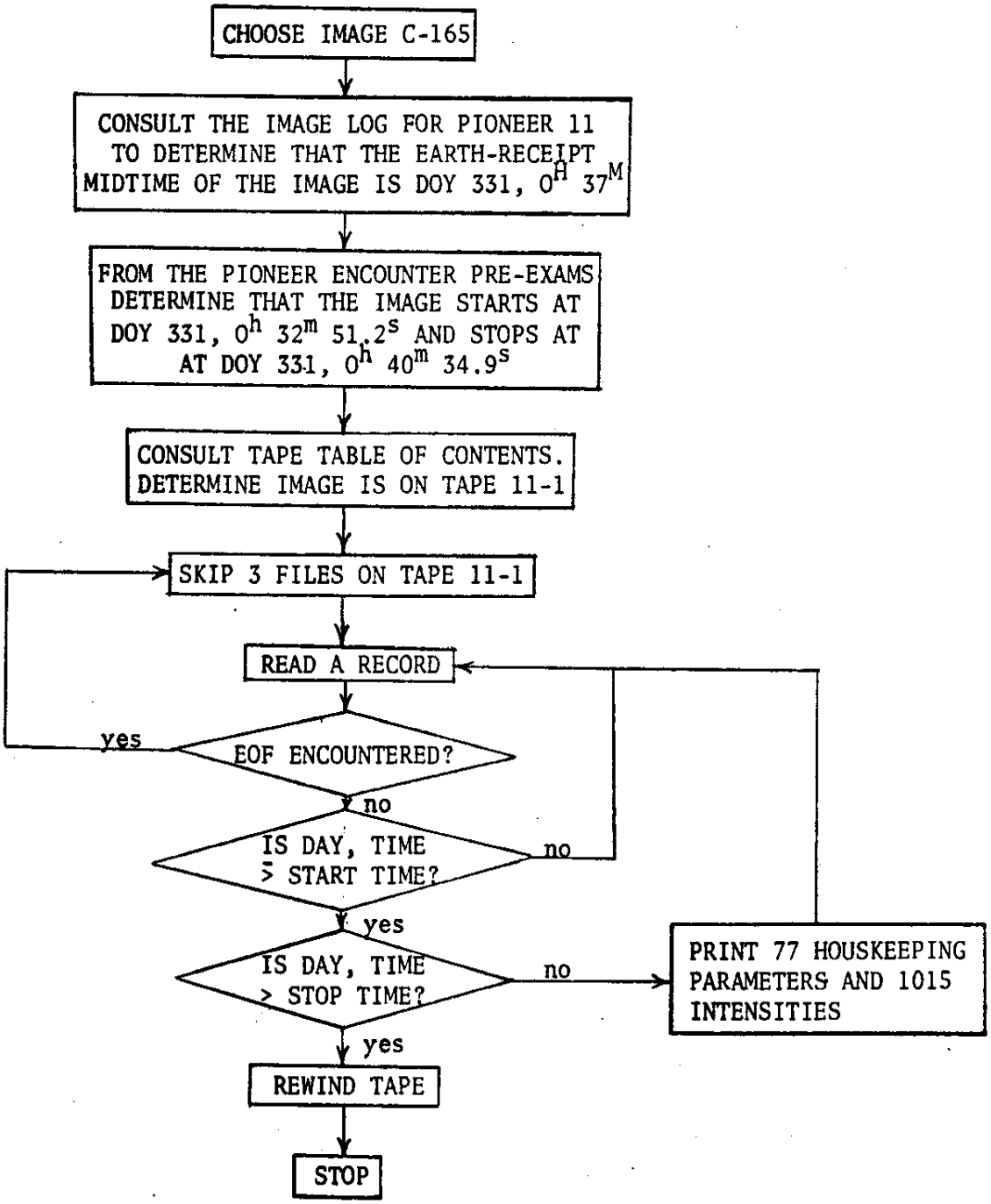
Detailed Contents of Files

File 4 (Experiment Data) (Con't.)

CHARACTER(S)	CONTENTS
268-270	ROLL starting spoke.
272	BS back step.
273	TO threshold.
274	LS low sample rate.
275-276	GAIN gain step.
281-282	START LOOK ANGLE the starting look angle number in the SLA register.
283-284	COARSE LOOK ANGLE.
285-286	FINE LOOK ANGLE.
287	APERTURE Mode 3 (.5mr, 8mr, λ/2, D) Mode 4 (.5mr).
288	SI step inhibit.
291-318	TEMP1 TO TEMP5 5 IPP temperature readings.
361-4080	1860 INTENSITIES. Each intensity is two characters. The intensities are in the order in which they were measured, i.e. blue, red, blue, red, etc. The time between consecutive measurements in one color is 1/1024 second (except in low sample rate when it is 1/512 second). Valid data numbers range from 0 to 63. -1 indicates invalid data. No more than 1015 intensities can be valid on one data cycle.

FIGURE 1

Mode 4 Data-Access Example



IPP HOUSEKEEPING

Definitions and Anomalies

1. Barker Code (Sync Code)[7 bits] = 114 almost always, but bits can be added when the spacecraft is irradiated.

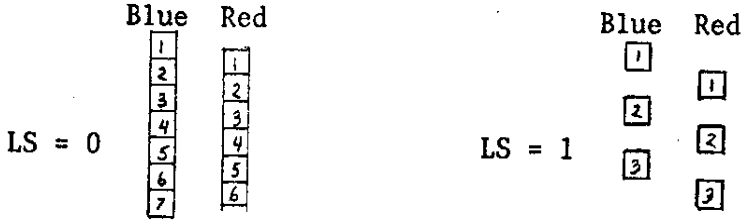
2. Mode I.D. [3 bits] 4:Mode 2, 2:Mode3, 1:Mode 4

3. Roll Spoke [8 bits] 0 → 255 (1.40625 degrees/spoke). Spoke 40 is the reset value ≃ -3.75 degrees (varies per instrument and other things too numerous to mention). Warning! When the threshold bit is not on, the last 2 (two) bits of the spoke are undefined, i.e. read the spoke as if the last 2 bits are 0 (modulo 4) regardless of whether they are zero or not. It is best to mask them off to zero when the threshold bit is not on (=0). When threshold is on (=1) the reading is precise to the nearest spoke.

4. Backstep Bit (BS) 1 = on, 0 = off. IPP backstep.

5. Threshold Bit (Th) 1 = on, 0 = off. Threshold scan. For a list of all the screwy things that this bit does see the IPP detailed instrument description. Good Luck!

6. Low Sample Bit (LS) 1 = on, 0 = off. IPP in low sample in Mode 4. Doubles the field of view in Mode 4 by not taking overlapping samples, e.g.:



In Mode 3 it doesn't affect the sampling, it just turns off the calibration lamp.

7. Gain Step Setting (GS) [5 bits] 0 → 27 steps with 12, 13, 14 and 15 missing (i.e. contiguously 9, 10, 11, 16, 17, 18). If the gain is bigger than 11 subtract 4 from it and flag the invalid combinations if they occur.

8. Starting Look Angle (SLA) [4 bits] see table:

SLA	Bits	Value	Approximate Cone Angle
1	0000	0	151°
2	0001	1	127° (SLA reset goes to here)
3	0011	3	109°
4	0111	7	90°
5	1111	15	66°
6	1110	14	29°
7	1100	12	10°

An IPY3 command at SLA = 7 sets the register to SLA 1. All other values (2, 4, 5, 6, 8, 9, 10, 11, 13) are invalid.

9. Fine Encoder Position [5 bits] A 24 position shaft encoder attached to the telescope stepping motor. Each 1 position change is equivalent to a telescope look angle change of 0.5 milliradians (0.0286478 degree). The step values are from 1 → 24. (About 0.688 degree/revolution)

10. Coarse Encoder Position [5 bits] A 5 bit position code from wipers mounted on gating tracks attached to the telescope itself, each being about 4.7 degrees apart. A code of 0 = 170° (end stop), and a code of 31 = 10° (solar difuser). (A code of 30 = 29°, there are no extra wipers between the edge of the antenna and the difuser. The rest, 29° → 170° are about the 4.7° apart. The exact values and spacings vary with each instrument.) Certain of the gate tracks are the starting look angles, which the instrument slews to when given a IPW3 or IPW4 command. (Or when the telescope hits the end stop 170°.) Note, that the fine encoder takes about 6.8 turns for every gate track crossed.

11. Aperture Code [6 bits] This 6 bit code tells what aperture is in place for this IPP data roll. (Exception when in Mode 3 the first 4 of 4, 5, 6, 4 is really a 3 (lamp roll).) The aperture codes are as follows:

AP Code	Bits	What It Is
1	001000	40 x 40 mr. open
2	010000	phosphor source
3	100000	0.5 mr (Mode 3 lamp/Mode 4 image)
4	000100	half wave 8 x 8
5	000010	depolarizer 8 x 8
6	000001	8 x 8 open (with corrector)

The aperture code has already been decoded on the EDR tapes. (This is the only field on the EDR tapes that has been decoded for you.)

12. Step Inhibit Bit 1 = on, 0 = off. IPP step inhibited. This bit says to the IPP don't step. (Has no effect in slew.) Also, if the threshold bit is on and no object in the 360° field of view (all the way around the roll) has 8 or more counts in channel 1 (BP), then the IPP will go ahead and step anyway. (If there are 8 or more counts the IPP will stay put.)

13. Spare Bits (3) These were bits for things thought of later to be sent down but they were never used, fortunately. They are currently used (because they are always zero) to separate false Barker Codes (data, intensities, that look like the start of housekeeping) from real Barker Codes, the start of a new roll. This is mainly a problem in Mode 4 at the lower bit rates 256, 512, 1024, when the entire data roll is not transmitted and a new roll starts right after the middle of the last one. The intensities are arranged such that the high order bits fall in the spare word and in the Barker Code. They need to be turned on to make a false Barker Code but off to make a false spare word. This is all that saved us from hand decoding rolls on P10 close approach.

14., 15., 16., 17., & 18. IPP Temperatures Temperatures are thermistor voltage readings from inside IPP, which correspond to the temperature of various places inside the case. See chart below:

T1 = blue channeltron (#1) temperature
T2 = red channeltron (#2) temperature
T3 = Phosphor source temperature
T4 = High voltage power supply temperature
T5 = Electronic cavity temperature

The voltage-temperature calibration is different for each sensor and each instrument. It also moves slightly with time, but it can tell you when anything is burning out. These temperatures are only taken in Mode 3! Values in Mode 4 and old Mode 3 values.

19. Mode 4 Intensities 508 x 2 channels, 6 bit intensities in the order B, R. (Note the last 2 bits of the last intensity 508R are not sent. No room in the spacecraft 6144 bit buffer for them.)

Appendix A

3.9 IMAGING PHOTOPOLARIMETER (UA/IPP) INSTRUMENT

The Imaging Photopolarimetry Experiment combines three investigations in the visible light range, sharing use of a single flight instrument. Zodiacal light mapping is to be conducted at intervals throughout the interplanetary flight, making use, in particular of unique observation opportunities in the mission to assess the quantity and distribution of particulate matter in space and to identify the nature of the particles. Periodic Zodiacal light measurements will be made during the flight measuring brightness and polarization of light over a wide range of scattering angles. Photometric and polarimetric studies of Jupiter, Mars and Saturn will be made at several ranges and phase angles, in 2 spectral bands and 2 polarization angles, simultaneously. Photopolarization measurements will be made of Jovian satellites if viewing is feasible during encounter. Photopolarization studies of asteroids and solid particulate matter in the asteroid belt will be made if viewing is feasible during transit through the belt. Finally, 2-color visible light imaging of Jupiter will be attempted by spin scan optical sensing, at encounter.

The flight instrumentation for Pioneer F/G, is an imaging photopolarimeter, consisting of an optical telescope positioned by a stepping motor, a beam-splitting optical prism, 2 sets of coupling and filtering optics, 4 channeltron detectors, signal processing, logic, control, interface and power circuitry, all contained in a single housing. The telescope which protrudes from the side of the spacecraft equipment compartment, has a 1" aperture, 3.4" focal length and provides an image with instantaneous fields of view of 40x40 mrad for Zodiacal light studies, 8x8 mrads for photopolarimetry and 0.5x0.5 mrad for imaging. (8)
The Wollaston prism splits the image into 2 orthogonally polarized beams which are filtered to 2 color channels; 3900-4900 Å (blue) and 5900-7000 Å (red). The stepping mechanism provides 0.5 milliradian scan angle stepping increments by ground command.

3.9.1 UA/IPP Telemetry Format Plan.

3.9.1.1 General. The UA/IPP instrument has four modes of operation, described in Sections 3.9.1.3 to 3.9.1.6. For all modes of operation except Mode 1, the data for the UA/IPP instrument are stored in the last section of the spacecraft digital storage unit (DSU) with a maximum allotment of 6144 bits. The data are readout from the DSU in two basic formats (Formats D-1 and D-2). In Format D-1, all of the available words (64 3-bit words) are assigned to the UA/IPP instrument as shown in Figure 3.9.1.1, sheet 1 of 2. In Format D-2, the last 56 words are assigned to the UA/IPP instrument and the first 8 words are assigned to the California Institute of Technology/Infrared Radiometer (CIT/IR) instrument as shown in Figure 3.9.1.1, sheet 2 of 2.

The data for the UA/IPP instrument are synchronous with the spacecraft telemetry word assignments; that is, the first data word of an instrument data cycle always appears in the first telemetry word assigned to the UA/IPP instrument regardless of instrument or spacecraft mode of operation. The complete instrument data cycle can be as long as 6144 bits so that many frames of Format D-1 or D-2 are required to complete the cycle. The bit stream is continuous so that a given instrument word may start at the end of one frame and continue into the next.

3.9.1.2 Housekeeping Data. Housekeeping data are part of the instrument input to the DSU in Modes 2, 3, and 4. These data are divided into two parts as shown in Figure 3.9.1.2. The first part (Status) provides information such as SYNC WORD, MODE IDENTIFICATION, ROLL POSITION, etc. The second part (Temperature) consists of five 10-bit TEMPERATURE words and appears in Modes 2 and 3 only. Modes 2, 3, and 4 are the active modes for ZODIACAL LIGHT, JUPITER PHOTOPOLARIMETRY, and JUPITER IMAGING measurements respectively.

3.9.1.3 Standby Mode 1. This is an automatic mode of operation when the instrument is turned on, but is not gathering and processing information. In the STANDBY MODE, the SYNC IDENTIFICATION word is not generated.

3.9.1.4 Zodiacal Light (ZL) Mode 2. In this mode of operation, the instrument presents a total of 2660 bits to the spacecraft memory during a data cycle. The remaining portion of the memory is not used. This portion, 3484 bits, may thus contain data from any source on the spacecraft obtained during some previous period when the DSU was being used and therefore can not be used for UA/IPP computation purposes. However, the total 6144 bits of data are read out by the S/C DTU and telemetered during the non-data-taking S/C rolls.

The time to read a complete data cycle into the memory is equal to or less than the time of one spacecraft revolution. The length of the read-in time is controlled by the instrument. The start of a data cycle occurs in alternate revolutions at a fixed spacecraft roll position. Read-out of the spacecraft memory occurs during times when no data are being read in. The full ZL cycle comprises 10 data cycles and thus requires 10 ROLL PAIRS to complete. Each data-gathering roll alternating with a telemetry roll. The roll sequence is as follows:

Roll Pair	#1	DARK CURRENT
	#2	PHOSPHOR SOURCE calibration
	#3-10	SKY READINGS through 40x40 mr aperture.

The output from each of the 4 channels is recorded 64 times during one data roll. Figure 3.9.1.4 shows the telemetry format for Mode 2. The first 100 bits contain both parts of the housekeeping data (see Figure 3.9.1.2); Figure 3.9.1.4 shows the "fixed words" in the housekeeping data corresponding to the Mode 2 data cycle. The remaining 2560 bits are composed of ZODIACAL LIGHT data taken in 64 position sectors.

3.9.1.5 Jupiter Polarimetry (JP) Mode 3. In this mode of operation, the instrument presents a total of 6144 bits to the spacecraft memory during a data cycle resulting in a DSU buffer area full condition. The time to read a complete data cycle into the DSU buffer area is approximately 2 seconds. The start of a data cycle occurs in each revolution at a spacecraft roll position selectable by ground command or by automatic selection when in the threshold operation. Read-out of the spacecraft memory occurs during times when no data are being read in and therefore the read-out time is less than one revolution. The full JP cycle normally comprises 4 data cycles and thus requires 4 spacecraft revolutions. However, when the instrument is searching for a threshold, a JP cycle comprises only 1 spacecraft revolution.

Figure 3.9.1.5 shows the telemetry format for Mode 3. As for Mode 2, the first 100 bits contain both parts of the housekeeping data (see Figure 3.9.1.2); Figure 3.9.1.5 shows the "fixed" words in the housekeeping data corresponding to the Mode 3 data cycle. The remaining portion of the DSU buffer area is filled with JUPITER PHOTOPOLARIMETRY data.

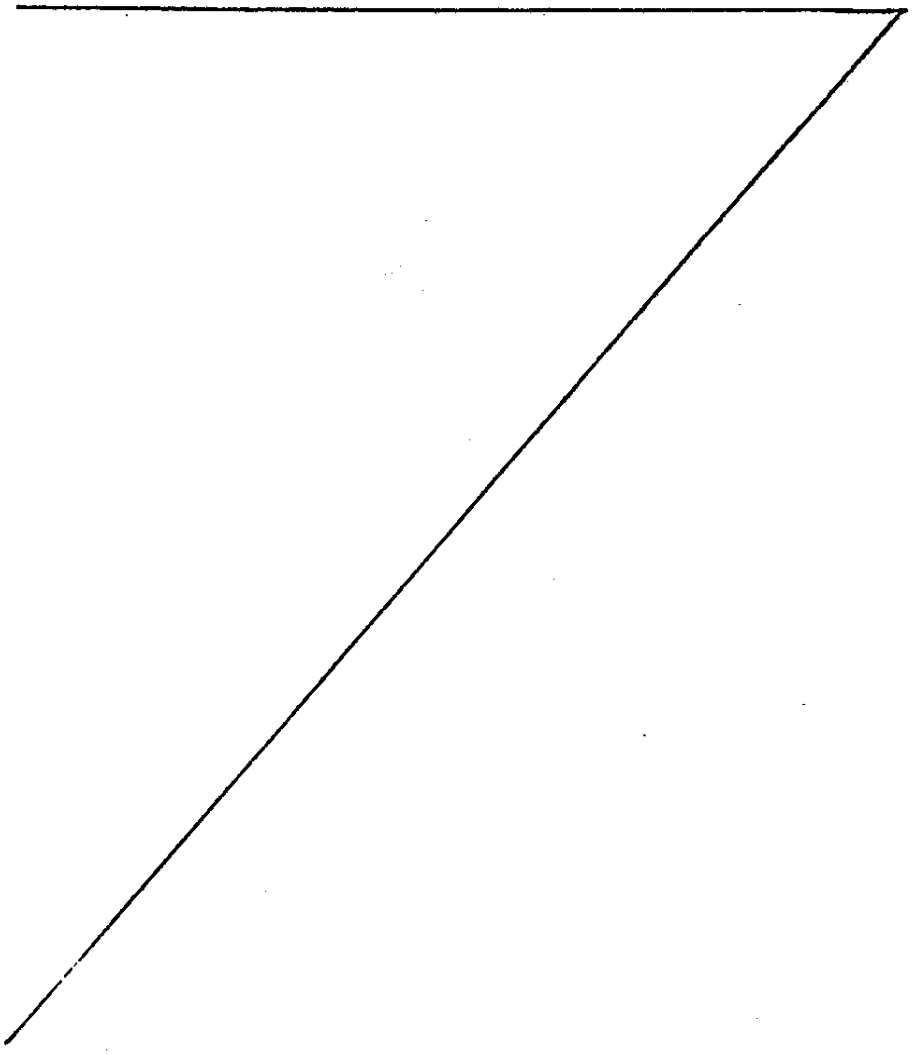
Two IPP operating sequences are possible in Mode 3. In Sequence 1 the instrument steps once per roll, always keeping Aperture #4 in the beam. This sequence occurs when automatically searching for an object bright enough to trigger Mode 3 threshold. In Sequence 2 the instrument steps once every four rolls, cycling between Apertures #3, 5, 6, and 4. Sequence 2 is detected by identifying the change of Aperture from #4 to #3. The first complete set of four rolls begins with the first observation with Aperture #3. However, it must be noted that the telemetry will indicate aperture #4 instead of #3, and the apparent sequence will be #4, #5, #6, #4..... (8)

3.9.1.6 Jupiter Imaging (JI) Mode 4. This mode of operation is similar to Mode 3 in that:

(a) The instrument presents 6144 bits to the spacecraft memory.
(b) Read-out occurs when no data are being read-in.

Mode 4 differs from Mode 3 in that read-in time is approximately 1/2 second, only the first part of the housekeeping data (status) is read into the spacecraft memory, and the aperture position is the same for all revolutions.

Figure 3.9.1.6 shows the telemetry format for Mode 4 including the "fixed" words in the first part of the housekeeping data corresponding to the Mode 4 data cycle.



3.9.2 Instrument Monitoring.

3.9.2.1 Status. All status words and bits shall be decommutated and monitored continuously (see Figure 3.9.1.2) whenever the instrument is in an active mode (Mode 2, 3 and 4) and Format D-1 or D-2 is active. Any uncommanded change in status shall cause an operator alarm message to be generated. The operator message shall identify the condition.

3.9.2.1.1 Housekeeping Status Bits. The UA/IPP instrument Bits 19, 20, 21 and 47 of Format D-1 or D-2 shall be monitored continuously whenever the instrument is in Mode 2, 3, or 4. If one of these bits goes from a "0" to a "1" without being the result of a command (see Sections 3.9.4.1, 3.9.4.4, 3.9.4.5, and 3.9.4.6), an operator alarm message shall be generated. The operator message shall identify the condition.

3.9.2.1.2 Mode. The software shall monitor the MODE ID whenever the UA/IPP instrument is in MODE 2, 3 or 4. If an uncommanded change to another MODE, other than to STANDBY, is detected, an operator alarm message shall be generated. The operator message shall identify the condition.

3.9.2.2 Standby Verification. The normal mode for the UA/IPP instrument will be the STANDBY MODE. In this mode, no data are sent except for Science Subcom Word E217, STANDBY VERIFICATION word. This word shall be continuously monitored and compared with the commanded status of the UA/IPP instrument. If the instrument status changes to an active mode (OFF STANDBY) without having been commanded to do so, an operator message shall be generated. The operator message shall identify the condition. The value of Word E217 shall be interpreted as follows:

STANDBY:	$52_8 \leq$ E217 $\leq 77_8$	(8)
OFF STANDBY:	$00 \leq$ E217 $\leq 06_8$	(8)
MALFUNCTION OR ERROR	$06_8 <$ E217 $< 52_8$	

3.9.2.3 Temperature. UA/IPP instrument temperatures are available only when the instrument is in Mode 2 or Mode 3. Five temperatures are available (See Figure 3.9.1.2).

T1 = BLUE CHANNELTRON TEMPERATURE

T2 = RED CHANNELTRON TEMPERATURE

T3 = PHOSPHOR, SOURCE TEMPERATURE

T4 = HV POWER SUPPLY TEMPERATURE

T5 = UA/IPP INSTRUMENT ELECTRONICS TEMPERATURE

An operator alarm message shall be generated if the limit conditions below are exceeded:

	T1	T2	T3	T4	T5
Upper Hard Limit:					
Upper Soft Limit:					
Nominal:	T.B.S.				
Lower Soft Limit:					
Lower Hard Limit:					

3.9.2.4 Power ON/OFF. The UA/IPP instrument POWER ON/OFF status shall be continuously monitored (channel C-124, Bit 1, "1" = ON, "0" = OFF). An operator alarm message shall be generated if an uncommanded change in the instrument POWER ON/OFF status is detected.

3.9.3 Science Data Monitoring. Whenever the UA/IPP instrument is in one of the active modes (MODE 2, 3, or 4), all science data shall be decommutated and monitored.

3.9.3.1 Synchronization. The UA/IPP instrument telemetry data cycle is of varying length depending upon instrument mode and telemetry bit rate. The beginning of each data taking cycle is identified by a 7 bit Barker Code (BC = 1110010). This code always appears as the first 7 bits of the first Format D-1 telemetry frame or bits 25 thru 31 for the first Format D-2 telemetry frame for that instrument data cycle. Mode 2 operation always stores 2660 bits in the spacecraft DSU in the Format D buffer area. Modes 3 and 4 fill this assigned buffer area of 6144 bits (See

section 3.9.1). However, the last 6 bits stored in the buffer area are not always valid and therefore should not be used in computations. Zeroes will be filled into Format D frames by the S/C DTU after the complete buffer area of 6144 bits has been read out until it is reloaded with new data. Zeroes will also be filled in the balance of a Format D frame from the point at which the UA/IPP instrument Data Store Gate becomes true and commences to store data in the DSU buffer area.

The SFOF and PMAA software shall synchronize on the UA/IPP Barker Code (BC). To avoid false lock, the UA/IPP synchronization routine shall examine only bits 1 thru 7 of Format D-1 and bits 25 thru 31 of Format D-2 telemetry frames. Once lock is established, the synchronization program search mode shall be inhibited until after "N" frames of Format D-1 or D-2 have been received. "N" must be determined from the UA/IPP instrument mode and the telemetry bit rate. In the search mode, the synchronization program shall look at each D-1 or D-2 frame for the Barker Code in the appropriate bit locations. Each time a BC is identified, the program shall store the telemetry data. As soon as two successive BC's are found separated by the correct number of frames for the specific instrument mode and telemetry bit rate, the lock mode shall be initiated. Data stored prior to the first legitimate BC shall be discarded.

The number of D-Frames, "N", between BC's may be calculated as shown below. The S/C DTU always sends complete frames, therefore, the number of frames between BC's is an integral number. However, at low telemetry bit rates and in MODES 3 and 4, the time required to complete a D-Frame with zero filler bits is lost from the available read-out time for the next instrument data cycle. Therefore, in order to assure not missing the next BC, the integral number of D-Frames, "N", during which the search mode is inhibited shall be the next smaller integer than the calculated decimal number of frames. However, if the S/C ROLL PERIOD (T_{ROLL}) exceeds 12 seconds, the second smaller integer than the "N" calculated shall be used. Therefore, the software shall be designed to readily accept a change in the number of frames during which the SEARCH MODE is inhibited once lock has been achieved.

MODE 2:

N = [1/192] FRAMES/BIT x [BIT RATE/2] BITS/SEC x [$2T_{ROLL}$] SEC

MODE 3:

N = [1/192] FRAMES/BIT x [BIT RATE/2] BITS/SEC x [T_{ROLL}-2] SEC

MODE 4:

N = [1/192] FRAMES/BIT x [BIT RATE/2] BITS/SEC x [T_{ROLL} -K] SEC, where K = 1/2 second for NORMAL SAMPLE RATE and K = 1 second for LOW SAMPLE RATE.

The synchronization algorithm shall be capable of recognizing and taking into account frames deleted by the Sequential Decoder and maintain lock.

3.9.3.2 Channeltron Saturation. The life of the CHANNELTRONS is severely shortened if a saturation condition is permitted to persist. In Modes 3 and 4, the UA/IPP instrument normally reduces GAIN automatically one increment per S/C ROLL whenever saturation occurs. Saturation is whenever a CHANNEL INTENSITY reading is all ONES. In MODE 2, the GAIN reduces automatically once per S/C ROLL PAIR whenever a CHANNEL INTENSITY of 15 times saturation occurs. The software shall monitor the CHANNEL INTENSITIES (See Figure 3.9.1.4, 3.9.1.5 and 3.9.1.6) and the instrument GAIN (See Figure 3.9.1.2 GAIN SETTING) continuously. (8) (8)

3.9.3.2.1 ZL Mode 2 Operation. If more than 10 successive SECTOR INTENSITY readings on any one channel during any one ROLL indicate saturation (all ONES) an operator message shall be generated. The operator message shall identify the condition and indicate how many successive SECTOR INTENSITY readings were saturated and both the SECTOR POSITION and LOOK ANGLE of the last saturated sector. (8)

3.9.3.2.2 JP Mode 3 and J1 Mode 4 Operation. An operator alarm message shall be generated if the CHANNEL INTENSITIES from CHANNELS 1, 2, 3, or 4 indicate SATURATION at the same GAIN SETTING for more than 2 sucessive S/C ROLLS or ROLL PAIRS. The operator message shall identify the condition and list the GAIN SETTING and which CHANNEL(s) is SATURATED. (8)

3.9.3.3 Gain. The GAIN SETTING (UA/IPP Bits #22-26) for each of the 10 ROLL PAIRS shall be compared to test whether the GAIN has changed during the data cycle. If the GAIN has changed, an operator message shall be generated specifying the old and new GAIN SETTINGS and the ROLL PAIR during which the change occurred. It shall be sufficient to identify a S/C ROLL PAIR with the FRAME NUMBER and the GMT Time for the frame in which the changed GAIN SETTING was received. Whenever the S/C is transmitting in a D-Format the SCID for the D-Frame is that of the preceeding Format A or B Frame.

3.9.4 Command Verification. The software shall verify the execution of all UA/IPP instrument commands transmitted (See Figure 3.9.1.2). The RTLT shall be taken into account while monitoring for command verification. Command verification of the commands specified below is possible only when the spacecraft is transmitting in Format D-1 or D-2.

3.9.4.1 Look Angle Step Inhibit. The LOOK ANGLE STEP INHIBIT command IPY1 inhibits telescope stepping. UA/IPP HOUSEKEEPING BIT 47 is the STEP INHIBIT (SI) status bit.

SI ENABLED: Bit 47 = "1"

SI DISABLED: Bit 47 = "0"

3.9.4.2 Start Look Angle Reset. The START LOOK ANGLE RESET command IPY2 sets the SLA register to POSITION 2 and then causes the UA/IPP instrument to go into the STANDBY MODE 1. Therefore, the execution of command IPY2 is verified by checking the contents of the SLA register (UA/IPP HOUSEKEEPING Bits 27 thru 30) and by observing the STANDBY VERIFICATION word (See Section 3.9.2.2). The instrument telescope will not move to the RESET POSITION 2 until the UA/IPP is subsequently commanded to one of the active modes. The UA/IPP instrument POWER OFF command IPY0 sets the SLA register to POSITION 1 and switches the instrument power off. The instrument telescope will not move to POSITION 1 until the POWER ON command IPY9 is commanded followed by a command to one of the active modes (MODE 2, 3, or 4).

3.9.4.3 Start Look Angle Increment. The START LOOK ANGLE INCREMENT command IPY3 sets the SLA register to a selected SLA by incrementing from the SLA in effect one step at a time. Command IPY3 cycles the SLA register increment until in POSITION 7. From POSITION 7 the SLA register next goes to POSITION 1. The command is verified by observing UA/IPP HOUSEKEEPING BITS 27 thru 30 and checking that they increment for each transmission of command IPY3 in accordance with Figure 3.9.1.2.

3.9.4.4 Look Angle Step Reverse. The LOOK ANGLE STEP REVERSE command IPY4 causes the direction of telescope stepping to be towards the spacecraft +Z axis. The reverse stepping will not occur until the telescope reaches the position in the SLA REGISTER at the time command IPY4 is received by the spacecraft. UA/IPP HOUSEKEEPING BIT 19, BS, is the status bit for this command. (8)

BS ENABLED: Bit 19 = "1"

BS DISABLED: Bit 19 = "0"

The effect of command IPY4 can only be reversed by sending any one of the active mode commands (IPW3, IPW4 or IPW5).

3.9.4.5 Low Sample Rate. The LOW SAMPLE RATE command IPY5 reduces the sample rate by half in MODE 4 only. Command IPY5 has no effect in any other mode. UA/IPP HOUSEKEEPING BIT 21, LS, is the status bit for this command.

LS ENABLED: BIT 21 = "1"

LS DISABLED: BIT 21 = "0"

Any subsequent execution of the MODE 4 ON command IPW5 will reset the LOW SAMPLE RATE status to LS DISABLED.

3.9.4.6 Start Data at Threshold. The START DATA AT THRESHOLD command IPY6 synchronizes the data taking to sensor threshold level. UA/IPP HOUSEKEEPING BIT 20, TO, is the status bit for this command.

TO ENABLED: BIT 20 = "1"

TO DISABLED: BIT 20 = "0"

3.9.4.7 Spoke Advance Fine. The SPOKE ADVANCE FINE command IPY7 is a cyclic command which advances the spoke wheel 1/64th of a spacecraft roll. The UA/IPP HOUSEKEEPING BITS 11 thru 18 indicate the ROLL POSITION. This command is verified by observing these bits and checking that the ROLL POSITION advances 1/64th of a roll from its previous position for each time the command is transmitted. The UA/IPP instrument resets to a ROLL POSITION value of 40 (decimal) whenever the instrument power is commanded OFF and then ON.

3.9.4.8 Spoke Advance Coarse. The SPOKE ADVANCE COARSE command IPY8 is a cyclic command which advances the spoke wheel 1/16th of a spacecraft roll. The UA/IPP HOUSEKEEPING BITS 11 thru 18 indicate the ROLL POSITION. This command is verified by observing these bits and checking that the ROLL POSITION advances 1/16th of a roll from its previous position for each time the command is transmitted.

IPY 1 ✓

3.9.4.9 Gain Increment. The GAIN INCREMENT command IPW1 increases the channeltron gain setting. UA/IPP HOUSEKEEPING BITS 22 thru 26 represent the GAIN SETTING. This command is verified by observing these bits and checking that the GAIN SETTING increments the correct amount from the previous GAIN SETTING for each time the command IPW1 is transmitted. The GAIN SETTING change for each transmission of command IPW1 is one GAIN SETTING increment (See Section 3.9.5.1.2) until GAIN SETTING 23 is reached.

3.9.4.10 Gain Decrement. The GAIN DECREMENT command IPW2 reduces the channeltron gain setting. The description for the GAIN INCREMENT command IPW1 applies except in the reverse direction. However, in MODE 4, the GAIN SETTING will not decrement below GAIN SETTING 12.

3.9.4.11 Mode 2 ON. The MODE 2 ON command IPW3 selects the ZODIACAL LIGHT MODE 2 operation. See Figure 3.9.1.2 for interpretations of the Mode ID Bits.

3.9.4.12 Mode 3 ON. The MODE 3 ON command IPW4 selects the JUPITER POLARIMETRY MODE 3 operation. See Figure 3.9.1.2 for interpretations of the MODE ID Bits. Execution of command IPW4 also causes the MSB (UA/IPP Bit 22) of the GAIN SETTING (See Figure 3.9.1.2) to be a "0".

3.9.4.13 Mode 4 ON. The MODE 4 ON command IPW5 selects the JUPITER IMAGING MODE 4 operation. See Figure 3.9.1.2 for interpretations of the MODE ID Bits. Execution of command IPW5 also causes the MSB (UA/IPP Bit 22) of the GAIN SETTING (See Figure 3.9.1.2) to be a "1".

3.9.5 Computations. The computations required will differ for each active mode of the UA/IPP instrument.

3.9.5.1 General Status. The software shall perform the STATUS computations specified below upon operator request.

3.9.5.1.1 Mode. The MODE ID shall be converted as follows:

MODE 2 --- 1 0 0 = M2ZL = 2

MODE 3 --- 0 1 0 = M3JP = 3

MODE 4 --- 0 0 1 = M4JI = 4

3.9.5.1.2 Gain. The instrument GAIN (UA/IPP Bits 22-26 of D-Format shall be converted to integer steps 0 thru 23. The conversion is as shown below:

Bits 22-26		GAIN
0 0 0 0 0	----	0
0 0 0 0 1	----	1
0 0 0 1 0	----	2
⋮	⋮	⋮

Bits 22-26		GAIN
0 1 0 1 1	----	11
1 0 0 0 0	----	12
1 0 0 0 1	----	13
1 0 0 1 0	----	14
⋮	⋮	⋮
1 1 0 1 1	----	23

3.9.5.1.3 Aperture Position. The APERTURE POSITION shall be converted to the CODE shown in Figure 3.9.1.2.

3.9.5.1.4 Starting Look Angle. The SLA shall be converted to degrees. The conversion of the SLA to degrees is shown below:

SLA		DEGREES
0 0 0 0	---	151°2 (measured from +Z AXIS)
0 0 0 1	---	127°7
0 0 1 1	---	108°9
0 1 1 1	---	90°1
1 1 1 1	---	66°6
1 1 1 0	---	29°0
1 1 0 0	---	10°0

3.9.5.1.5 Look Angle. The LOOK ANGLE shall be converted to degrees measured from the +Z-AXIS (the +Z-AXIS is normally pointing opposite to the direction of S/C motion). The LOOK ANGLE in degrees is from UA/IPP Bits 31-40 of the D-Format. The LOOK ANGLE is telemetered as an INPUT (FINE) POSITION and an OUTPUT (COARSE) POSITION (See Figure 3.9.1.2). The OUTPUT POSITION reading conversion to degrees is as shown below: (8)

OUTPUT POSITION IN BINARY	LOOK ANGLE IN DEGREES	SLA POSITION	INPUT POSITION IN BINARY
1 1 1 1 1	10.0	7	T.B.S.
1 1 1 1 0	29.0	6	
1 1 1 0 1	33.7	-	
1 1 1 0 0	38.4	-	
1 1 0 1 1	43.1	-	
1 1 0 1 0	47.8	-	T.B.S.
1 1 0 0 1	52.5	-	
1 1 0 0 0	57.2	-	
1 0 1 1 1	61.9	-	
1 0 1 1 0	66.6	5	
1 0 1 0 1	71.3	-	
1 0 1 0 0	76.0	-	
1 0 0 1 1	80.7	-	
1 0 0 1 0	85.4	-	
1 0 0 0 1	90.1	4	
1 0 0 0 0	94.8	-	T.B.S.
0 1 1 1 1	99.5	-	
0 1 1 1 0	104.2	-	
0 1 1 0 1	108.9	3	
0 1 1 0 0	113.6	-	
0 1 0 1 1	118.3	-	
0 1 0 1 0	123.0	-	
0 1 0 0 1	127.7	2	
0 1 0 0 0	132.4	-	
0 0 1 1 1	137.1	-	
0 0 1 1 0	141.8	-	T.B.S.
0 0 1 0 1	146.5	-	
0 0 1 0 0	151.2	1	
0 0 0 1 1	155.9	-	
0 0 0 1 0	160.6	-	
0 0 0 0 1	165.3	-	
0 0 0 0 0	170.0	-	

The INPUT POSITION reading changes by one binary increment for every telescope output position change of 0.5 mrad. Except for the first 2 OUTPUT POSITIONS in the above table, it requires 184 telescope steps of 0.5 mrad each to move the 4.7° between the successive OUTPUT POSITION increments. Therefore, the INPUT POSITION reading will cycle 5.125 times between each OUTPUT POSITION binary increment.

3.9.5.1.6 Housekeeping Status Bits. The UA/IPP Bits 19, 20, 21 and 47 of the D-Format shall be converted to alphanumeric symbols as follows:

UA/IPP BIT NR.	1	0
19	B	
47	I	—
20	T	—
21	L	—

3.9.5.1.7 Roll Position. The ROLL POSITION value (UA/IPP BITS 11-18, D-Format) shall be converted to a decimal integer and then scaled as follows:

$$ROL.P = [\text{ROLL POSITION}] \times [360/256] \times K$$

where K = T.B.S.

3.9.5.2 Temperature. The UA/IPP temperature (See Figure 3.9.1.2) shall be converted to decimal numbers.

3.9.5.3 Zodiacal Light Mode 2. Each 10-bit instrument data word shall be converted to a decimal number.

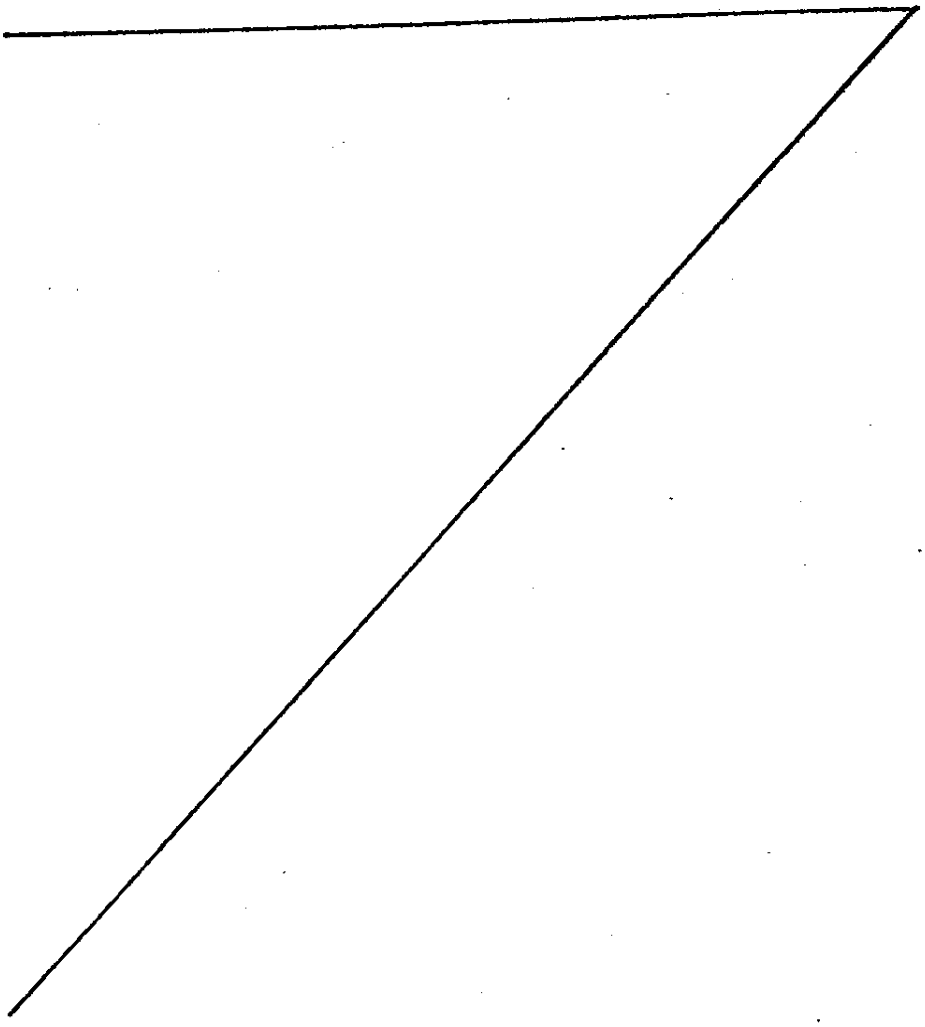
3.9.5.4 Jupiter Polarimetry Mode 3. The computations specified below shall be performed whenever the UA/IPP instrument is operating in the JUPITER PHOTOPOLARIMETRY MODE 3, M3JP.

3.9.5.4.1 Intensities. The INTENSITIES, CHANNEL words BP, BS, RP, and RS (See Figure 3.9.1.5), shall be converted to decimal values, where:

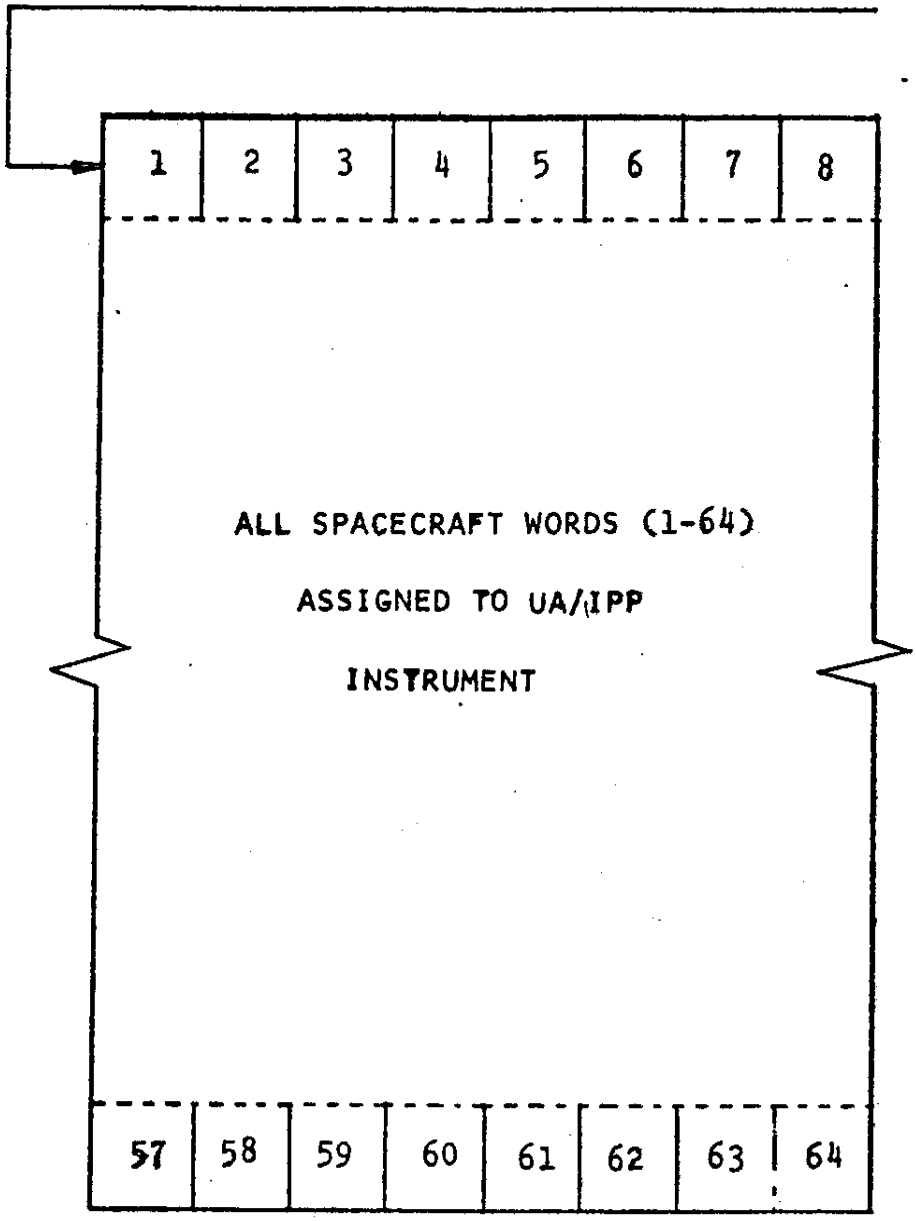
BP = I2 BLUE
BS = I1 BLUE
RP = I2 RED
RS = I1 RED

3.9.5.5 Jupiter Imaging Mode 4. The data processing requirements for the JUPITER IMAGING MODE 4, M4JI are:

T.B.S.



FORMAT D-1 SPACECRAFT WORDS



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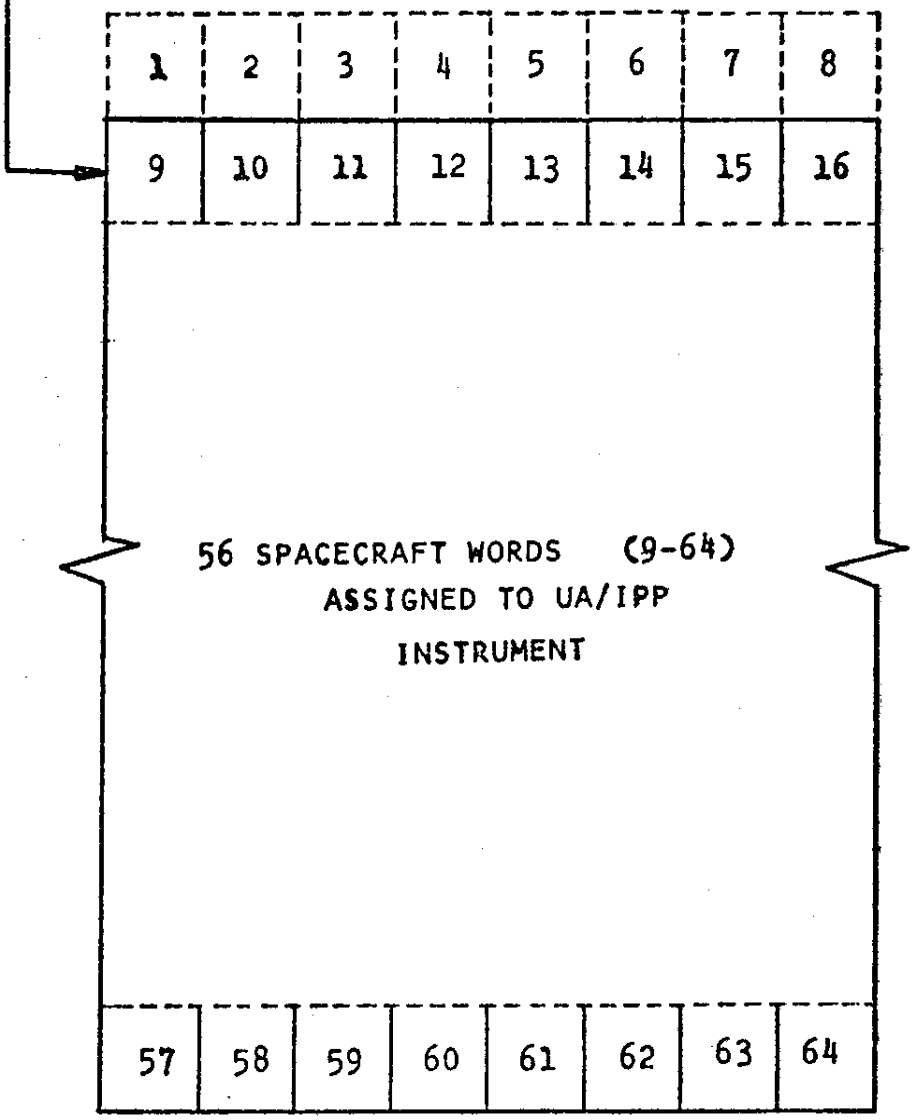
		DOC NO. PC-261.04
		FIG. 3.9.1.1
	REV. NO. 3 DATE	SHEET 1 OF 2

PORMAT D-2 SPACECRAFT WORDS



NOTE: SPACECRAFT WORDS 1 TO 8
ARE ASSIGNED TO CIT/IR INSTRUMENT

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		DOC NO. PC-261.04
		FIG 3.9.1.1
	REV. NO 3 / DATE	SHEET 2 OF 2

BIT NO.	1	2	3	4	5	6	7	8	9	10
WEIGHTING	(NOTE 1)							(NOTE 2)		
DATA	SYNC CODE							MODE ID		

BIT NO.	11	12	13	14	15	16	17	18	19	20
WEIGHTING	$2^7/2^5$	$2^6/2^4$	$2^5/2^3$	$2^4/2^2$	$2^3/2^1$	$2^2/2^0$	$2^1/X$	$2^0/X$	2^0	I/O
DATA	ROLL POSITION								BS	TO

(Note 6)

BIT NO.	21	22	23	24	25	26	27	28	29	30
WEIGHTING	2^0	12_{10}	2^3	2^2	2^1	2^0	(NOTE 3)			
DATA	LS	GAIN SETTING					STARTING LOOK ANGLE			

BIT NO.	31	32	33	34	35	36	37	38	39	40
WEIGHTING	2^4	2^3	2^2	2^1	2^0	2^4	2^3	2^2	2^1	2^0
DATA	OUTPUT (COARSE) POSITION					INPUT (FINE) POSITION				
	LOOK ANGLE									

BIT NO.	41	42	43	44	45	46	47	48	49	50
WEIGHTING	(NOTE 4)						2^0			
DATA	APERTURE POSITION						SI	SPARE		

NOTES:

(1) Fixed Bits 1110010

(2)

Mode	Code	Bits
2	M2ZL	100
3	M3JP	010
4	M4JI	001

(3)

SLA	Bits
1	0000
2	0001
3	0011
4	0111
5	1111
6	1110
7	1100

(4)

Aperture Position	AP	Bits	CODE
40 x 40 MR	1	001000	4C
Phosphor	2	010000	PH
0.5 MR	3	100000	05
8 MR Open	4	000100	-8
Half-Wave Plate	5	000010	HW
Depolarizer	6	000001	DP

(5) BS = Back Step
TO = Threshold On
LS = Low Sampling Rate
SI = Step Inhibit

(6) When TO = 0, Bits 17 and 18 have no significance. Other bit weighting is as shown for TO = 0 and 1 respectively. TO Enabled = "1", TO Disabled = "0".

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FORMAT PLAN
STATUS HOUSEKEEPING
FORMATS D-1 AND D-2

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DATE 10/22/71

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FIG 3.9.1.2

SHEET 1 OF 2

BIT WEIGHTING	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

BIT NO.	51	52	53	54	55	56	57	58	59	60
DATA	TEMPERATURE - BLUE CHANNELTRON - T1									

BIT NO.	61	62	63	64	65	66	67	68	69	70
DATA	TEMPERATURE - RED CHANNELTRON - T2									

BIT NO.	71	72	73	74	75	76	77	78	79	80
DATA	TEMPERATURE - PHOSPHOR SOURCE - T3									

BIT NO.	81	82	83	84	85	86	87	88	89	90
DATA	TEMPERATURE - HV POWER SUPPLY - T4									

BIT NO.	91	92	93	94	95	96	97	98	99	100
DATA	TEMPERATURE - ELECTRONICS - T5									

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FIG 3.9.1.2
SHEET 2 OF 2

BIT NO.	DATA	DATA SOURCE OR FIXED BITS		
		ROLL PAIR 1 (0.5 MR)	ROLL PAIR 2 (PHOSPHOR CAL.)	ROLL PAIR 3 TO 10 (40 x 40 MR)
1 to 7 8 to 10	SYNC MODE	1110010 100	1110010 100	1110010 100
41 to 46	AP	100000	010000	001000
101 to 110 111 to 120 121 to 130 131 to 140	Sec. 1	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS
141 to 150 151 to 160 161 to 170 171 to 180	Sec. 2	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS
2621 to 2630 2631 to 2640 2641 to 2650 2651 to 2660	Sec. 64	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS

NOTES:

(1) B = Blue
R = Red
P = Parallel
S = Senkrecht (Perpendicular)

(2) AP = Aperture Position
Sec = Sector
Ch = Channel

(3) Bit weighting for 10-bit channel data is 2^9 to 2^0 with most significant bit first.

REPRODUCED FROM

TITLE: UA/IPP TELEMETRY FORMAT PLAN MODE 2 DIGITAL DATA FORMATS D-1 AND D-2

REV NO 3 | DATE

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD CALIFORNIA

DOC NO PC-261.04

FIG 3.9.1.4

SHEET 1 OF 1

BIT NO.	DATA	DATA SOURCE OR FIXED BITS			
		ROLL 1 (0.5 MR)	ROLL 2 (HALF-WAVE PLATE)	ROLL 3 (DEPOLARIZER)	ROLL 4 (8 MR OPEN)
1 to 7 8 to 10	SYNC MODE	1110010 010	1110010 010	1110010 010	1110010 010
41 to 46	AP	000100	000010	000001	000100
101 to 110 111 to 120 121 to 130 131 to 140	Sec. 1	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS
141 to 150 151 to 160 161 to 170 171 to 180	Sec. 2	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS
6101 to 6110 6111 to 6120 6121 to 6130 6131 to 6140	Sec. 151	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS	Ch. 1 - BP Ch. 2 - RP Ch. 3 - BS Ch. 4 - RS

NOTES:

(1) B = Blue
R = Red
P = Parallel
S = Senkrecht (Perpendicular)

(2) AP = Aperture Position
Sec. = Sector
Ch. = Channel

(3) Bit weighting for 10-bit channel data is 2^9 to 2^0 with most significant bit first.

TITLE: UA/IPP TELEMETRY FORMAT PLAN MODE 3 DIGITAL DATA FORMATS D-1 AND D-2

REV NO 3 | DATE

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD CALIFORNIA

DOC NO PC-261-04

FIG 3.9.1.5

SHEET 1 OF 1

BIT NO.	DATA	DATA SOURCE OR FIXED BITS ALL ROLLS (0.5 MR)
1 to 7 8 to 10	Sync Mode	1110010 001
41 to 46	AP	100000
51 to 56 57 to 62	Sec. 1	CH 1 - BLUE CH 2 - RED
63 to 68 69 to 74	Sec. 2	CH 1 - BLUE CH 2 - RED
6123 to 6128 6129 to 6134	Sec. 507	CH 1 - BLUE CH 2 - RED
6135 to 6140 6141 to 6144	Sec. 508.	CH 1 - BLUE CH 2 - RED (NOTE 2)

NOTES:

(1) AP = Aperture Position
SEC = Sector

(2) Two least significant bits of CH 2, Sec. 508 not telemetered

(3) Bit weighting for 6-bit channel data is 2^5 to 2^0 with most significant bit first

REPRODUCED FROM	TITLE	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD, CALIFORNIA
	UA/IPP TELEMETRY FORMAT PLAN MODE 4 DIGITAL DATA FORMATS D-1 AND D-2	DOC NO. PC-261.04 FIG. 3.9.1.6
	REV NO 3 DATE	SHEET 1 OF 1

MS	YR	GMT TIME	ROL.P	LOOK ANG DEG	STEP	SLA	AP	GS	BITL	T1	T2	T3	T4	T5
3F	2	DDD HH MM SS	358.6	169.9	23	151	DP	23	BITL	999	999	999	999	999

MS = INSTRUMENT MODE/SPACECRAFT
YR = LAST DIGIT OF YEAR
ROL.P = ROLL POSITION
AP = APERTURE POSITION
GS = GAIN SETTING
B = BACK STEP
I = STEP INHIBIT
T = THRESHOLD ON
L = LOW SAMPLE RATE
T1 = BLUE CHANNEL TEMPERATURE
T2 = RED CHANNEL TEMPERATURE
T3 = PHOSPHOR SOURCE TEMPERATURE
T4 = HV POWER SUPPLY TEMPERATURE
T5 = ELECTRONICS TEMPERATURE

NOTE: 1. HEADINGS MAY BE SUPPRESSED ON LINE PRINTER OR PRINTED ONLY ONCE AT START OF EACH OUTPUT.
2. MODE 4 DOES NOT HAVE TEMPERATURE DATA.

TITLE: UA/IPP HOUSEKEEPING AND STATUS DATA, FORMATS D-1 AND D-2, OUTPUT DATA FORMAT

REV NO 9 | DATE 10/22/71

PIONEER PROGRAM
NASA
AMES RESEARCH CENTER
MOFFETT FIELD, CALIFORNIA

DOC NO PC-261.04

FIG 3.9.6.1.2

SHEET 1 OF 1

Appendix B

3.3 DOCUMENT CONTROL

This specification shall be subject to rigid document control by NASA/ARC. In the event changes are required to this specification, replacement, or additional pages will be furnished by NASA/ARC. Replacement or additional pages will be appropriately labeled to indicate change and dates of changes.

4. PRODUCT ASSURANCE PROVISIONS

Not applicable

5. HANDLING, SHIPPING, AND STORAGE

Not applicable.

6. NOTES

6.1 ABBREVIATIONS

See section 6.1 of Specification PC-262.00 entitled Pioneer Off-Line Data Processing System at ARC.

6.2 GLOSSARY OF TERMS

See section 6.2 of Specification PC-262.00 entitled Pioneer Off-Line Data Processing System at ARC.

6.3 CLARIFICATION OF EXPERIMENTER DATA RECORD ACS PARAMETERS (Figure 6.3)

This note clarifies the inter-relationship of the Attitude Control System (ACS) parameters in the fixed header of each physical record of File 4 on the Experimenter Data Record (EDR), output by the Pioneer Off-Line Data Processing System (POLDPS) at ARC. The ACS parameters in the fixed header of the EDR are the spin period and flag, Roll Attitude Timer, Roll Pulse/Roll-Index Pulse phase error, and the GMT time of the frame in which the six most significant bits of the Roll Attitude Timer (C-112) occur. Also included will be the Roll Pulse and Roll-Index Pulse definitions which are related to the ACS parameters found on the EDR.

(a) Roll Pulse (P_R) - A pulse generated by the Attitude Control Subsystem each time the spacecraft +Y axisascends through a plane it establishes as a reference plane for the spacecraft attitude control system. Measurement Jitter and the spacecraft position relative to the sun and earth line may establish inaccuracies between this reference plane and a plane parallel to the ecliptic,Figure 6.3 shows this measurement as a possible band about the reference plane.

(b) Roll Index Pulse (P_F) - A filtered roll pulse generated by the Spin Period Sector Generator (SPSG) which occurs once per spacecraft revolution.

(c) P_8 Pulse - A square wave generated by the SPSG, which occurs with a frequency 8 times that of and in phase with the P_F pulse.

(d) P_{64} Pulse - A square wave generated by the SPSG, which occurs with a frequency 64 times that of and in phase with the P_F pulse.

(e) P_{512} Pulse - A pulse generated by the SPSG, which occurs with a frequency 64 times that of and in phase with the P_F PULSE.

(f) Roll Attitude Timing - The DTU contains a redundant 12-bit counter which is driven by a 128 bps clock and controlled by the Roll Index Pulse (P_F). The 12 bits of the counter are read out with the most significant bit first during Engineering Subcom Word C-112 and C-116 (DRATC). The counter is reset with each occurrence of the Roll-Index Pulse after the end of word gate C-125, at which time counting is resumed. The 12-bit count represents the time between the occurrence of the Roll-Index Pulse and the start of word C-112 of the Engineering Subcom. This telemetered time will permit correlating the attitude of the roll and the roll-index reference lines with given telemetered science and engineering data. Each count within the register represents 0.0078125 seconds.

(g) Roll Pulse/Roll-Index Pulse phase error (ARIPPHEC) - The phase error measurement between the Roll Pulse and Roll-Index Pulse with up to a miximum of x62.5 msec of phase error, generated by the SPSG.

(h) Spin Period Flag - A three bit flag extracted from Engineering Subcom Word C-417, which indicates the SPSG modes and the SPSG roll reference.

Bit 1 (ASPSGRRS):

(1) 0 indicates that the roll index pulse is in phase with the roll pulse.
(2) 1 indicates that the roll index pulse is 180 degrees out of phase with the roll pulse.

Note: The relationship between the phase of the Roll Pulse and the Roll-Index Pulse is corrected on the spacecraft by Ground Command. However, by using the spacecraft attitude information and the status of Bit 1 and ARIPPHEC, it can be verified that the correction was actually made. In general it shall never be permitted to exceed the dynamic range of ARIPPHEC.

Bits 2 and 3 (ASPSGMS):

(1) 00 - Non-averaging
(2) 01 - ACS Mode
(3) 10 - Averaging
(4) 11 - Not used

(i) GMT of the RAT - This time represents the GMT time of the first bit of the main frame in which C-112 occurs.
(j) Spin Period (ASPNPDC) - The time between two successive roll pulses.

The time of the main frame containing Engineering Subcom Word C-112 of the Roll Attitude Timer, the Spin Period and Flag, and the Roll Pulse/Roll-Index Pulse phase error is provided so that the experimenter can relate his data to the roll reference line of the spacecraft. The following will be a typical example of how these data may be used to find the time difference between the occurrence of Engineering Subcom Word C-112 and the occurrence of the Roll Reference Pulse. Also, it will show how the angle subtended between the roll reference line and any given scientific data bit can be obtained. (Reference Figure 6.3)

New RAT Determination. Data word C-112 contains the MS Bits and C-116 and LS Bits of the Roll Attitude Timer (RAT). These 12 bits shall be monitored until a change occurs between successive readings. This represents a New RAT (NEWRAT) and shall be used for processing.

Given the time of the first bit of the science main frame in which a change of Engineering Subcom Word C-112 occurs, and utilizing bit rate, the time of the first bit of Engineering Subcom Word C-112 can be extrapolated as follows:

$$GMT_{C\text{-}112_{Bit\ 1}} = T_{MF_{C\text{-}112}} + \frac{N_{Bits}}{BR\ (Bits/Sec)}$$

where: $T_{MF_{C\text{-}112}}$ - Time of the first bit of the main frame in which Engineering Subcom Word C-112 occurs.

N_{Bits} - The number of bits between the first bit of the main frame and the first bit of Engineering Subcom Word C-112. This value is equal to 108.

BR - The bit rate in which the data were transmitted.

$GMT_{C\text{-}112_{Bit\ 1}}$ - Time of the first bit of Engineering Subcom Word C-112.

At this time, the time occurrence of the Roll-Index Pulse can easily be obtained by the following relationship:

$$T_{RIP} = GMT_{C\text{-}112_{Bit\ 1}} - DRATC$$

where: T_{RIP} will be the time of the Roll-Index Pulse, which triggers the count of the Roll Attitude Timer.

(T_{PR}) is obtained by the addition or subtraction of the Roll Pulse/Roll-Index Pulse phase error. Bit 6 of Engineering Subcom Word C-408 determines whether C-408 is added or subtracted. If Bit 6 is one, the Roll Pulse occurred before the Roll-Index Pulse and the Roll Pulse/Roll-Index Pulse phase error must be subtracted from T_{RIP} as follows:

$$GMT_{PR} = T_{RIP} - ARIPPHEC$$

Otherwise, the Roll Pulse/Roll-Index Pulse phase error must be added to T_{RIP} (Bit 6 of C-408 equal to zero) as follows:

$$GMT_{PR} = T_{RIP} + ARIPPHEC$$

This indicates that the Roll-Index Pulse occurred before the Roll Pulse. However, this value on the EDR will be converted to engineering units and the proper sign is already assigned to the value of ARIPPHEC.*

After obtaining the time (GMT) of the occurrence of the Roll Pulse, the angle relationship between any bit of data and the roll reference line, of which bit rate and format must be taken into consideration, can be obtained. The following relationship is an example of how this angle is acquired:

$$\angle \text{Data Bit} = \frac{\left[\left(GMT_F\ (\text{Sec}) + \frac{M_{Bits}}{BR_{(Bits/Sec)}}\right) - GMT_{PR}\ (\text{Sec})\right] \text{X360 deg/rev.}}{\text{ASPNPDC (Sec/Rev)}}$$

where: $\angle$Data Bit - Angle subtended between a specific data bit reference line and the spacecraft roll reference line.

GMT_F - Time of the first bit of the main frame in which the particular data bit occurs.

M_{Bits} - The number of bits between the data bit being examined and the first data bit of the main frame in which it occurs.

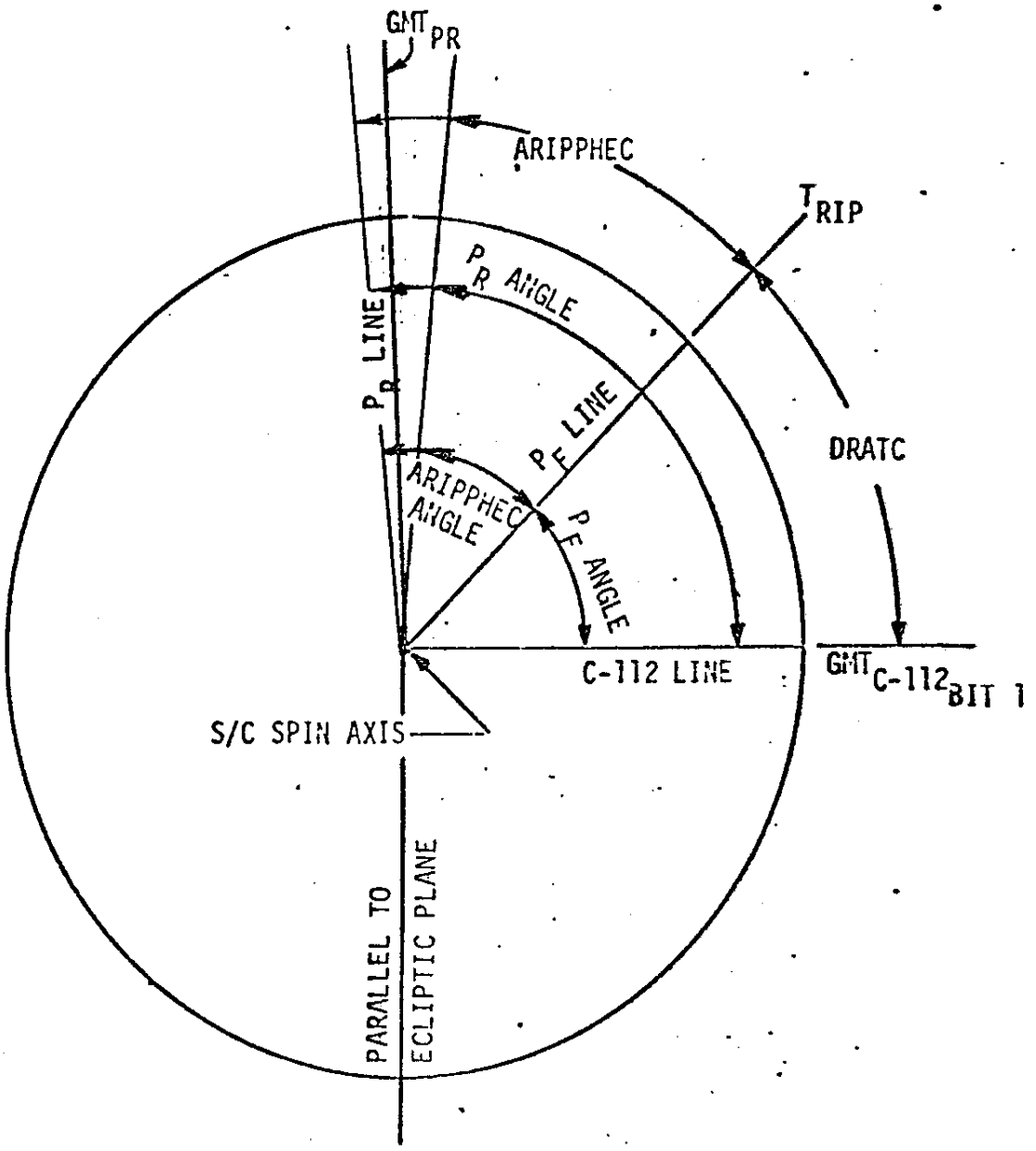
ASPNPDC - Spacecraft spin period (see definition #10).

BR - Telemetry bit rate in which the data was received.

GMT_{PR} - The time (GMT) that the spacecraft +Y axis passed, ascending, through the plane parallel to the ecliptic.

Using the instrument's look reference line, the relationship of any bit of data from the instrument to the spacecraft roll reference line can be determined.

*It should be noted that ARIPPHEC has jitter (sensor and electronic trigger errors) contained within its steady state values. To avoid the addition of this jitter into "$\angle$ Data Bit" or GMT T_{PR}", the least square Estimate (linear) Phase Error should be used in lieu of each ARIPPHEC at the time of occurrence of T_{RIP}. The technique for this utilization is a requirement in the Real-Time Data Processing System and is covered in detail in PC-261.01, Pioneer F/G: On-Line Ground Data System Software Specification for Mission Control at Space Flight Operations Facility in Section 3.5.1.1.4.



REPRODUCED FROM	TITLE: S/C ROLL REFERENCE RELATIONSHIP	PIONEER PROGRAM NASA AMES RESEARCH CENTER MOFFETT FIELD CALIFORNIA
		DOC NO PC-262.02
		FIG 6.3
	REV NO / DATE 9/1/71	SHEET 1 OF 1

```
      1                 PROGRAM COPTAV(OUTPUT=/480,TAVE1=692,TAVE2=/3520,TAPE1=TAVE1,
                       .  TAPE2=TAVE2)
                        INTEGER A, C(4),E(11),G, K(2), M(56), P, R, HEADER(48)
                        REAL B(4), F(2), J(2), L, INTEN(400)
      5                 DO 55 NN = 1,23
                      5 READ(1) HEADER
                        IF(EOF(1) .NE. 0) STOP 7777
                        READ(1) I
                        IF(EOF(1) .EQ. 0) STOP 7775
     10                 WRITE(2,25) HEADER
                     25 FORMAT(48A10)
                        ENDFILE 2
                        N = 120    — STANDARD LENGTH record = 30 sectors × 4 channels
                        IF(NN .EQ. 3 .OR. NN .EQ. 4 .OR. NN .EQ. 5) N = 320 } PROVIDES for variable length
     15                 IF(NN .EQ. 6) N = 220                                  record
                        R = 0
                        PRINT 30, HEADER
                     30 FORMAT(4(5X12A10/))
                     35 READ(1) A,B,C,D,E,F,G,H,I,J,K,L,M,INTEN
     20                 IF(EOF(1) .EQ. 0) GO TO 40
                        ENDFILE 2
                        GO TO 55
                     40 IF(R .GT. 0) GO TO 45
                        WRITE(2,42) A,B
     25              42 FORMAT(I3,4F8.2)
                     45 WRITE(2,50) C,D,E,F,G,H,I,J,K,L,M,(INTEN(P),P=1,N)
                     50 FORMAT(I12,3I6,F9.3,I3,I6,I4,I2,I12,2I6,I3,3I1,2F12.4,
                       . I6,6X,F12.4,I12,2F6.3,I6,I12,F6.2,36I1,I18,I6,6X,I12,3I6,1X,
                       . 3I1,I2,I6,2I2,2I1,5I6,340F8.3)
     30                 R = R +1
                        GO TO 35
                     55 CONTINUE
                        END
```

CARD NR.	SEVERITY	DETAILS	DIAGNOSIS OF PROBLEM
11	I	20 CD 11	FIELD WIDTH IS GREATER THAN 137 CHARACTERS. IT MAY EXCEED THE I/O DEVICE CAPACITY.
11	I	21 CD 11	TOTAL RECORD LENGTH IS GREATER THAN 137 CHARACTERS. IT MAY EXCEED THE I/O DEVICE CAPACITY.
27	I	35 CD 29	FIELD WIDTH IS GREATER THAN 137 CHARACTERS. IT MAY EXCEED THE I/O DEVICE CAPACITY.
27	I	38 CD 29	TOTAL RECORD LENGTH IS GREATER THAN 137 CHARACTERS. IT MAY EXCEED THE I/O DEVICE CAPACITY.

SYMBOLIC REFERENCE MAP (R=3)

ENTRY POINTS	DEF LINE	REFERENCES
6273 COPTAV	1	

```
VARIABLES      SN  TYPE          RELOCATION
  6514  A          INTEGER                        REFS      3      24     DEFINED     19
  6717  B          REAL          ARRAY            REFS      4      24     DEFINED     19
  6526  C          INTEGER       ARRAY            REFS      3      26     DEFINED     19
  6524  D          REAL                           REFS     26  DEFINED     19
  6532  E          INTEGER       ARRAY            REFS      3      26     DEFINED     19
  6723  F          REAL          ARRAY            REFS      4      26     DEFINED     19
  6515  G          INTEGER                        REFS      3      26     DEFINED     19
  6525  H          REAL                           REFS     26  DEFINED     19
  6637  HEADER     INTEGER       ARRAY            REFS      3      10     17  DEFINED      6
  6522  I          INTEGER                        REFS     26  DEFINED      8     19
  6727  INTEN      REAL          ARRAY            REFS      4      26     DEFINED     19
  6725  J          REAL          ARRAY            REFS      4      26     DEFINED     19
  6545  K          INTEGER       ARRAY            REFS      3      26     DEFINED     19
  6520  L          REAL                           REFS      4      26     DEFINED     19
  6547  M          INTEGER       ARRAY            REFS      3      26     DEFINED     19
  6523  N          INTEGER                        REFS     26  DEFINED     13     14      15
  6521  NN         INTEGER                        REFS   3*14      15     DEFINED      5
  6516  P          INTEGER                        REFS      3      26     DEFINED     26
  6517  R          INTEGER                        REFS      3      23     30  DEFINED     16      30

FILE NAMES       MODE
     0  OUTPUT     FMT                  WRITES     17
  2127  TAPE1      UNFMT                 READS      6      8     19
  3454  TAPE2      FMT                  WRITES     10     24     26     MOTION     12      21
  2127  TAVE1
  3454  TAVE2

EXTERNALS        TYPE    ARGS     REFERENCES
        EOF      REAL       1            7      9     20

STATEMENT LABELS              DEF LINE   REFERENCES
     0  5          INACTIVE        6
  6412  25         FMT            11         10
  6421  30         FMT            18         17
  6340  35                        19         31
  6351  40                        23         20
  6453  42         FMT            25         24
  6356  45                        26         23
  6474  50         FMT            27         26
  6367  55                        32          5     22

LOOPS  LABEL    INDEX      FROM=TO    LENGTH    PROPERTIES
  6276  55      * NN          5 32       748              EXT REFS

STATISTICS
  PROGRAM LENGTH              12708      696
  BUFFER LENGTH               62638     3251
  PIONEER F EDR 24 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/14/73 REGENERATED   /  /   117/72 DSIF NO. 41,51
  TLM BIT RATES  256
  TLM FORMATS  A/D1
  MODES  RT            START TIME 14/06 STOP TIME 23/59 TAPE SEQUENCE NO.  1                    PLUM RUN

  PIONEER F EDR  2 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  4/25/73 REGENERATED   /  /   133/72 DSIF NO. 41,61
  TLM BIT RATES 2048
  TLM FORMATS  A/D1
  MODES  RT            START TIME 14/42 STOP TIME 23/59 TAPE SEQUENCE NO.  1                    PLUM RUN

  PIONEER F EDR  6 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/14/73 REGENERATED   /  /   167/72 DSIF NO. 42,51,61
  TLM BIT RATES   16,2048
  TLM FORMATS     B, A/D1
  MODES  RT            START TIME 17/09 STOP TIME 23/59 TAPE SEQUENCE NO.  1                    PLUM RUN
```

HEADER RECORD

```
PIONEER F EDR  6 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/14/73 REGENERATED   /  /   167/72 DSIF NO, 42,51,61
TLM BIT RATES   16,2048
TLM FORMATS     B, A/D1
MODES  RT           START TIME 17/09 STOP TIME 23/59 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR 20 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/14/73 REGENERATED   /  /   168/72 DSIF NO, 12,42,51
TLM BIT RATES 2048
TLM FORMATS  A/D1
MODES  RT           START TIME 00/00 STOP TIME 23/59 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  4 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/13/73 REGENERATED   /  /   169/72 DSIF NO, 12,51
TLM BIT RATES 2048
TLM FORMATS  A/D1
MODES  RT           START TIME 00/00 STOP TIME 02/32 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  4 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/20/73 REGENERATED   /  /   185/72 DSIF NO, 41,61
TLM BIT RATES 2048
TLM FORMATS  A/D1
MODES  RT           START TIME 14/53 STOP TIME 23/59 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  6 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/24/73 REGENERATED   /  /   186/72 DSIF NO, 42,61
TLM BIT RATES 2048
TLM FORMATS  A/D1
MODES  RT           START TIME 11/59 STOP TIME 23/59 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  2 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/20/73 REGENERATED   /  /   187/72 DSIF NO, 11,61
TLM BIT RATES 2048
TLM FORMATS  A/D1
MODES  RT           START TIME 00/00 STOP TIME 04/13 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  2 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/20/73 REGENERATED   /  /   230/72 DSIF NO, 11,51
TLM BIT RATES  512,1024
TLM FORMATS  A/D1
MODES  RT           START TIME 17/35 STOP TIME 23/59 TAPE SEQUENCE NO,  1      EDITTED-- 09/08/75  PLUM RUN

PIONEER F EDR  3 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  3/15/73 REGENERATED   /  /   231/72 DSIF NO, 11,42,51
TLM BIT RATES  512,1024
TLM FORMATS  A/D1
MODES  RT           START TIME 00/00 STOP TIME 18/02 TAPE SEQUENCE NO,  1                                    PLUM RUN

PIONEER F EDR  4 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  5/15/73 REGENERATED   /  /   305/72 DSIF NO, 12,14,41
TLM BIT RATES  256,1024
TLM FORMATS  A/D1
MODES  RT           START TIME 00/00 STOP TIME 23/37 TAPE SEQUENCE NO,  1                                    PLUM RUN
```

```
09/30/76 UNIV. OF ARIZONA 3.4 LVL 355AL  08/15/76
14.28.37.$J  LONNYZ6  FROM 12   09/30/76
14.28.37.JOBCARD=LONNY,BN9702693 ,MT2,T100,DAL00.
14.28.37.   COPY TAVE FOR P/10 1972
14.28.37.VSN(TAVE1=041220,TAVE2=JTV108)
14.28.38.FTN(R=3)
14.30.18.       .454 CP SECONDS COMPILATION TIME
14.30.18.REQUEST(TAVE1,RO,NL,HI)
14.31.42.( MT31 ASSIGNED)
14.31.42.MT31 VOLUME SERIAL NUMBER IS  041220, RO
14.31.42.REQUEST(TAVE2,RI,NL,HI,S,PW=*----*)
14.34.41.ASSIGN 32.
14.34.42.( MT32 ASSIGNED)
14.34.42.MT32 VOLUME SERIAL NUMBER IS  JTV108, RI
14.34.42.REWIND(TAVE1,TAVE2)
14.34.43.FILE(TAVE1,RT=S,BT=C)
14.34.43.FILE(TAVE2,RT=S,BT=C,CM=YES)
14.34.43.LDSET(FILES=TAVE1/TAVE2)
14.34.45.LGO.
14.34.49.      326568 CM REQUIRED FOR LOADING.
14.34.49.MT31 VOLUME SERIAL NUMBER IS  041220, RO
14.34.54.MT32 VOLUME SERIAL NUMBER IS  JTV108, RI
14.37.09.MT31 BLOCKS READ= 001194
14.37.09.     $TOP  7777
14.37.09.     35.133 CP SECONDS EXECUTION TIME
14.37.09.UNLOAD(TAVE1,TAVE2)
14.37.09.TRANSF(LONNY)
14.37.10.      TRANSFERRED TO LONNYZD
14.37.10.      TRANSFERRED TO LONNYY1
14.37.10.      TRANSFERRED TO LONNYYG
14.37.10.      TRANSFERRED TO LONNYYO
14.37.10.OP  00000020 BLOCKS, FILE OUTPUT , OC 40
14.37.10.  RS= 12
14.37.10.CD  00000046 CARDS,  COST =       $.00
14.37.10.TP  02 TAPES ASSIGNED, COST=    $.80
14.37.10.CP       37.288 SEC.        21.173 ADJ.
14.37.10.IO       89.944 SEC.        13.491 ADJ.
14.37.10.CM      888.384 KWS.        14.458 ADJ.
14.37.10.SS                          49.124
14.37.10.COST     $3.52/TOTAL     $2.72/SS     $.80/MISC
14.37.10.** TOTAL COST DOES NOT INCLUDE PRINT AND PUNCH COSTS **
14.37.10.EJ  END OF JOB, 12, MAX CM USED= 460008

 LONNY                OUTPUT = 1                ROUTE TO 12


PRINTED 5 PAGES, 471 LINES, COST $0.25.  SPOOLER RAN 1 SECONDS, 4 KCS, 26 DISK READS, 2 DISK WRITES.
```

C 18778 5/30/73

FILE 1 RECORD 1 482 BYTES

PIONEER G EDR 2 ACQUISITIONS UA/IPP S/C ID 24 GENERATED 6/21/73 REGENERATED / / 150/73 DSIF NO. 42,51 TLM BIT RATE S 2048
TLM FORMATS A/D1
MODES RT START TIME 16/05

STOP TIME 23/59 TAPE SEQUENCE NO. 1 PLUM RUN 2

```
FILE 1      RECORD      1          38 BYTES
  3   10.75   97.78  200.10  271.40>6
```

PIONEER 11

POLARIZATION DATA ON TAPE

73-019A-07F

This data set has been restored. There were originally twelve 7-track, 556 BPI tapes written in BCD. There is one restored tape written in ASCII. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tapes were created on a 6400 computer. The DR and DS numbers along with the corresponding D numbers are as follows:

DR#	DS#	D#	FILES	TIME SPAN
DR004027	DS004027	D028963	1 - 242	05/30/73 - 10/29/76
		D029203	243 - 270	11/23/74 - 11/23/74
		D029202	271 - 272	11/28/74 - 11/28/74
		D029201	273 - 274	11/29/74 - 11/29/74
		D029200	275 - 276	11/30/74 - 11/30/74
		D029199	277 - 278	12/01/74 - 12/01/74
		D029198	279 - 280	12/02/74 - 12/02/74
		D029666	281 - 300	12/03/74 - 12/03/74
		D029665	301 - 308	12/04/74 - 12/04/74
		D029664	309 - 320	12/05/74 - 12/05/74
		D029663	321 - 340	12/06/74 - 12/07/74
		D029662	341 - 352	12/08/74 - 12/09/74

o Read error occurred in record 7 of File 280.

Refer to 72-012A-07F

D-28962

```
$JOB  10:33:10
$NOP BCD-LIST  OF TAPE X-434
$ASS IN MS6
$EXEC LIST BS                                    4/24/72 - 7/20/75

INPUT PARAMETERS ARE:  BC SR=1=1

 TAPE NO.   1              FILE NO.   1
 RECORD   1                LENGTH   480
PIONEER F EDR 24 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED  2/14/73 REGENERATED   /  /  117/72 DSI
F NO. 41,51          TLM BIT RATES  256
                                    TLM FORMATS  A/D1
                                                          MODES  RT            START TIME 14/06
 STOP TIME 23/59 TAPE SEQUENCE NO.  1                                  PLUM RUN

***** JOB DONE.
$AVF IN 1
$EXEC LIST BS

INPUT PARAMETERS ARE:  BC SR=1=2

 TAPE NO.   1              FILE NO.   1
 RECORD   1                LENGTH   36
  3    8.64   59.15  203.50  279.90>

 TAPE NO.   1              FILE NO.   1
 RECORD   2                LENGTH   1278
    58419316   117     0      2    4.340 41      4    024       288224  6097      0  1000       7.2578
  12.5047     6            -13.6718     583147322?.890 3.336      1     58332745 45.503333333300000000
00000000000000000     5837?259      2              58419316   114      2    144 00017      2 71141    466
470   468   655   722   5.000   4.000   3.125   4.000   5.000   3.750   3.125   4.000   5.000   3.5
00   3.125   3.875   5.000   3.625   3.375   3.750   5.000   3.625   3.000   3.750   5.000   3.750
  3.000   3.750   5.000   3.625   3.125   3.875   5.000   4.125   3.375   4.000   5.000   3.625   3
.375   3.750   5.125   3.625   3.000   3.625   5.000   3.625   3.000   3.500   5.000   3.625   3.12
5   3.625   5.000   3.375   3.000   3.625   5.000   3.250   3.000   3.500   5.000   3.250   3.125
 3.625   5.000   3.500   3.000   3.375   5.000   3.375   3.000   3.375  42.875  33.250  54.000  46.
750  59.500  49.500  75.625  67.750   5.000   3.375   3.250   3.750   5.000   3.250   3.125   3.125
   5.000   3.250   3.000   3.375   5.000   3.375   3.000   3.375   5.000   3.375   3.000   3.125
5.125   3.125   7.125   3.250   5.000   3.125   3.000   3.125   5.000   3.000   3.000   3.167   4.8
33   3.250   3.000   3.000   5.000   3.667   3.000   3.333   5.000   3.000   3.000   3.000

***** JOB DONE.
$AVF IN 198
$EXEC LIST BS

INPUT PARAMETERS ARE:  BC SR=1=2 2

 TAPE NO.   1              FILE NO.   1
 RECORD   1                LENGTH   480
PIONEER F EDR  2 ACQUISITIONS   UA/IPP S/C ID 23 GENERATED 10/02/75 REGENERATED   /  /  201/75 DSI
F NO. 14             TLM BIT RATES  512,1024,2048
                                    TLM FORMATS  B/D1
                                                          MODES  RT            START TIME 10/23
 STOP TIME 20/48 TAPE SEQUENCE NO.  1                                  PLUM RUN

 TAPE NO.   1              FILE NO.   2
 RECORD   1                LENGTH   36
  3   -2.53   208.14  176.00  220.80>

 TAPE NO.   1              FILE NO.   2
 RECORD   2                LENGTH   958
    40672457   201     0      2    5.590 14      5    016       7687266    958      0  0000       8.9375
  12.6521     6            1.9531     4053842327.890 2.884      1     40643425 32.303383333333333330
00000000000000000     40662180     55              40672457   114      2    226 01017      417 841    352
```